

Material Evidence for Urbanism in Archaic Crete

By
Andrew Cabaniss

Senior Honors Thesis
Department of Classics
University of North Carolina at Chapel Hill

04/01/2015

Approved:

Donald Haggis, Thesis Advisor

Kenneth Sams, Reader

Carla Antonaccio, Reader

Contents

List of Figures	v
List of Tables	vii
Abstract	ix
Acknowledgments	xi
I Methods	1
1 Activity from Artifacts	3
1.1 From Objects to Function	4
1.2 Economy in the First Millenium BCE Aegean	13
2 Social Material	19
2.1 Social Groups from Objects	19
2.2 Houses to Households	24
2.3 Households to Settlements	30
2.4 Social Trends in the first millennium Aegean	33
3 Quantitative Reasoning for Archaeology	37
3.1 Why Numbers?	37
3.2 Spatial analysis	40
II Material	45
4 Azoria	47
4.1 Material Evidence and Data	48
4.2 Textile Production at Azoria	56
4.3 Food Production at Azoria	61
4.4 Spatial Organization of Buildings	68
4.5 Interaction and Organization at Archaic Azoria	74

5	Social and Economic Transformations in Archaic Crete	83
5.1	Prinias	84
5.2	A Model of Social Organization and Change	87
5.3	Urbanism in Archaic Crete	94
	Bibliography	97

List of Figures

1.1	Limits of Possibility for Textile Production Given Loom weights	8
4.1	Site plan of Azoria.	49
4.2	Mass and thickness of loom weights at Azoria.	60
4.3	Counts of ground stone tools plotted by building and function.	64
4.4	Probability distribution of spinning by building at Azoria.	70
4.5	Probability distribution of weaving by building at Azoria.	71
4.6	Probability distribution of food processing by building at Azoria.	72
5.1	Benefits of the different social organizational schemes.	92
5.2	Benefits of having more contacts in a family-organized society or switching to a class-oriented society.	93

List of Tables

4.1	Guttman scaling of preserved material by building.	52
4.2	Number of rooms categorized into each category of access to light.	55
4.3	Percentage displacement of objects based on architectural limits.	55
4.4	Spindle whorls by weight and building.	57
4.5	Summary of loom weights by building.	59
4.6	Ground stone tool counts by building.	65
4.7	Knife and obolos counts by building.	66
4.8	The room with the highest expected probability from the spatial analysis.	73

Abstract

Archaic Cretan urbanism has been described by its heterogeneity and lack of definition. Although the study of early Cretan settlements by American archaeologists dates to the turn of the 20th century, more complex analyses of these data are still emerging. This work seeks to understand Archaic urbanism in Cretan settlements by placing the specific body of material at Azoria in East Crete within a broader theoretical and analytical context.

The first part, focusing on methods, deals with the background of theory that enables material evidence to be used to understand the past. I discuss approaches that enable economic and social inferences to be gleaned from artifacts, houses, and settlements, as well as the larger historical narratives that cover the Archaic period in the Aegean. I also discuss the basis for quantitative inference and its applicability to archaeology as a means of dealing with knowledge and uncertainty.

The second part deals with two particular sites, Azoria and Prinias, which currently inform much of the discussion of Archaic Cretan urbanism. With access to the unpublished catalog of small finds from Azoria, as well as the project's databases, I carry out an extensive analysis of the small finds from the late Archaic levels to define the preservation of the site and to treat the tools used for food processing and textile production. I then link these with the spatial information from houses and the public buildings in order to infer complex labor organization and public-household distinctions in Archaic Azoria. I finish with the juxtaposition of Prinias with Azoria as alternate forms of social organization and settlement transformation. I build a small numerical model that provides some small insight into how population may alter social preferences, with the implication that other such explanatory models need to be developed to better understand the heterogeneity of Cretan urbanism rather than merely describe it.

Acknowledgments

Many thanks go to many people for this project. Donald Haggis, Jen Gates-Foster, and Peter Mucha have been excellent mentors throughout my time at Carolina, much as Scott Ortman and Luis Bettencourt have been at SFI. The Azoria Project and its staff (Melissa Eaby, Peggy Mook, Rodney Fitzsimons, Margaret Scarry, Flint Dibble, etc.) have provided useful insight as well as data that is essential to this project. Further gratitude is due to Carla Antonaccio, Tim Shea, Catharine Judson, Julia Juhasz, Kline Gilbert, and many others with whom conversations have helped clarify my thinking.

Special thanks go to my parents, who have been supportive of an archaeologist, and Cathy Lydon, who made me into one.

Part I

Methods

Chapter 1

Activity from Artifacts

Objects are not as simple as they appear. Although most objects are directly associated with a small subset of activities, developments over the past few decades have increased the breadth of information recoverable from individual artefacts and assemblages through the consideration of use patterns, residue analysis, ethnographic and experimental parallels, and comparison within analogous archaeological contexts. Some may complain that these fields are becoming overly theorized, but every inference has a theory behind it, stated or not: recent work has excelled at declaring assumptions and checking how accurately they reflect reality. By understanding more information about the component objects of assemblages in a rigorous manner, higher-order inferences about the spatial, temporal, and social structuring of economic activities can be formulated and developed to test hypotheses on the scale of communities and settlements.

Here I first undertake a review of how we interpret the material remains associated with two major activities, namely textile production and food processing. I then proceed to treat the scholarship on observable trends in economic organization as well as the breadth and scale of activities in settlements during the first millennium BCE in the Aegean. I also elaborate on the dearth of scholarship concerning cooperation and economic coordination in Greek urbanization, and propose some initial starting points.

1.1 From Objects to Function

1.1.1 Textile production

Before the mechanization of textile production, at least as much domestic labor was spent on making fabric as was on procuring food.¹ Even without the time from growing and harvesting fibers from animals or crops such as flax, hundreds of hours were spent in the spinning, dyeing, and weaving of textiles just for domestic use. The most archaeologically visible equipment are clay spindle whorls and weights, which have allowed a greater characterization of spinning and weaving than other activities such as the cultivation of fibers and the dyeing of thread.

Spinning

Spinning would have required considerably more time than weaving for most types of fabric. In the surveys of traditional textile production conducted by Barber, spinning was a ubiquitous and portable activity: women spun while traveling or watching children, and held working bees to produce sufficient thread as a social group.² The spindle is largely known archaeologically through the fired ceramic whorl attached at the end, which is one of the most common finds at archaeological sites.³ The study of these whorls is still in its infancy, as sufficiently diverse collections and experimental conditions have not yet enabled many specific trends to be identified. Generally, larger whorls are best for producing thicker threads, which in turn allow for thicker and coarser fabrics.⁴ These effects can be enhanced or mitigated by the length of the spindle, however, which leads to notable uncertainty in inferring the types of thread spun on a given spindle.

Given the focus of previous scholarship on bronze age textiles, as well as limitations on whorl documentation, little has been said about specific developments or trends in the Early Iron Age and Archaic periods. Although some scholars have attempted to use spindle whorls as a marker of gendered space, evidence increasingly supports spinning to be both a male and female activity,

¹Barber 1995: 31.

²Barber 1995: 31; 85-7.

³Blegen 1963: 95; Eaby 2013.

⁴Mårtensson et al. 2006a,b.

especially when economic specialization is concerned.⁵ Sailors as well as male weavers may spend a portion of their time spinning thread for their own use; the gendered ideal of female spinning appears to decrease as these jobs become more frequent. Although the majority of spinning may be done by women, it is unclear that by the Archaic and Classical periods we should read spinning as a gendered task.

Spinning is easily social and portable, allowing it to accompany other activities and interactions. A broader reading for the contexts of spinning would take into account both this social element as well as the ease of portability. Spindle whorls are thus unlikely to be used only in the spaces they are found, but in large numbers they may suggest storage for group production of thread on an informal basis, such as in the working parties mentioned above and paralleled elsewhere in 20th century Greece.⁶ The quantity or clustering of whorls would not correlate with spinning necessarily in that space, but rather the scale of production and the degree of group participation. The only possible correlate for use may be the presence of broken spindle whorls in habitation contexts, although these may be reused for other purposes such as weights.⁷

Weaving

The final product of weaving is often undetectable archaeologically, although it requires significant amounts of energy and skill to accomplish. Weaving did not just produce textiles, however; the cooperation and social interactions associated with cloth manufacture would have had important consequences for the social ties between nuclear families.⁸ Cloth production could provide extra household income, and in some cases households converted otherwise domestic spaces into weavers' workshops.⁹ The scale and quality or type of fabric woven thus correlate with different social interactions and economic strategies, and these must be distinguished in order to construct useful interpretations.

⁵Thompson 1982; Barber 1995: 257-8; Nevett 1999: 40.

⁶Halstead 2014: 308.

⁷Fiedler 2005.

⁸Barber 1995: 86-7.

⁹Sofianou 2011: 427-430; Cahill 2005; Vogeikoff-Brogan 2011.

The number of loom weights required to form a loom is an oft debated problem. The question has several different answers depending upon the type of fabric woven, the type of loom in question, the loom weights in use, and the archaeological evidence for looms. Experimental studies at the Center for Textile Research in Copenhagen (CTR) routinely use around twenty loom weights to weave fabric .5m wide, but this is more of a minimum than an average. Cahill uses 20 to 40 as a range of loom weights per loom, while various small clusters as well as assemblages of up to 140 have been found at Trypitos Siteias.¹⁰ 22 loom weights were found in the living quarters of house C at Athens in Tsakirgis' study, while a loom at Troy had several rows of loom weights for over a meter of fabric.¹¹ Although more evidence would certainly help diversify the picture, two rows of at least ten loom weights appears to be a common minimum, while more than several dozen points to multiple looms and an increased scale of production.

Work on Bronze Age fabrics has focused on the diversity of loom weights found across the Aegean, linking different weights and thicknesses to different final products. The CTR has conducted many experimental studies that identified the boundaries of possibility for textile production given different sets of loom weights.¹² These limits are worth reviewing, as they can inform our interpretation of individual groups of weights; it should be noted, however, that all work to date has focused on tabby weaves, which differ in the structuring of warp and weft threads from the dominant twill weaves of the EIA and onward and thus in the physical limitations imposed by weights.

The mass of a loom weight must be entirely supported by the threads it holds taut; surpassing the tensile force of a group of threads will cause them to tear, while providing too little tension makes the process of changing sheds between warps difficult. The mass of the loom weight must take into account both the strength of the threads (related to their thickness) and the number of threads per loom weight. This can range between 5 and 30 threads per weight in an ideal case and between 4 and 40 in the limits of possibility.¹³ The thread count per centimeter must also fall

¹⁰Cahill 2005; Sofianou 2011; Vogeikoff-Brogan 2011.

¹¹Tsakirgis 2005; Blegen 1963: 71-72.

¹²Mårtensson et al. 2009, 2006a, 2007.

¹³Mårtensson et al. 2009.

in a manageable range in order to construct a fabric that is sufficiently dense to have structure yet adequately sparse to allow the passage of the shuttle. These limits depend upon the thickness of the thread woven and can be graphed in terms of the observable quantities of the loom weights, namely the thickness and weight (fig. 1.1.1). Loom weights plotted against these limits fall within regions of possibility for different grades of fabric, ranging from the fine, dense fabrics associated with clothing to thicker, coarse fabrics used for cloth sacks. The greater labor investment associated with fine fabrics is useful in characterizing the domestic economy: as well as estimating the duration of social interactions associated with weaving, it implies the ability to mobilize labor to spin fine thread, which would take hours longer compared with the less onerous coarse fabrics. Thus, variations in the scale and type of weaving can inform our interpretation of social and economic organization on a context-by-context basis.

1.1.2 Food

Food production, storage, processing, preparation, and consumption comprise much of detectable domestic economy. For most settlements in the Late Bronze Age and Early Iron Age, agriculture and pastoralism were the dominant modes of producing food, supplemented by hunting. Much of this is not observable in the original landscape contexts where farmers and herders worked, but evidence instead comes from the material remains associated with processing and storing food in better preserved contexts.

Food storage

The size and durability of terracotta storage vessels make storage one of the most archaeologically visible functions of a room. The contents of pithoi and other vessels are generally assumed either on the basis of literary sources (e.g. Xenophon *Oeconomicon*) or on residue analysis, with further corroboration from charred botanical remains where preserved and collected.¹⁴ McLoughlin, however, has identified differences in the designed functional properties of pithoi at Zagora

¹⁴Psaraki et al. 2013; Sarpaki 1992.

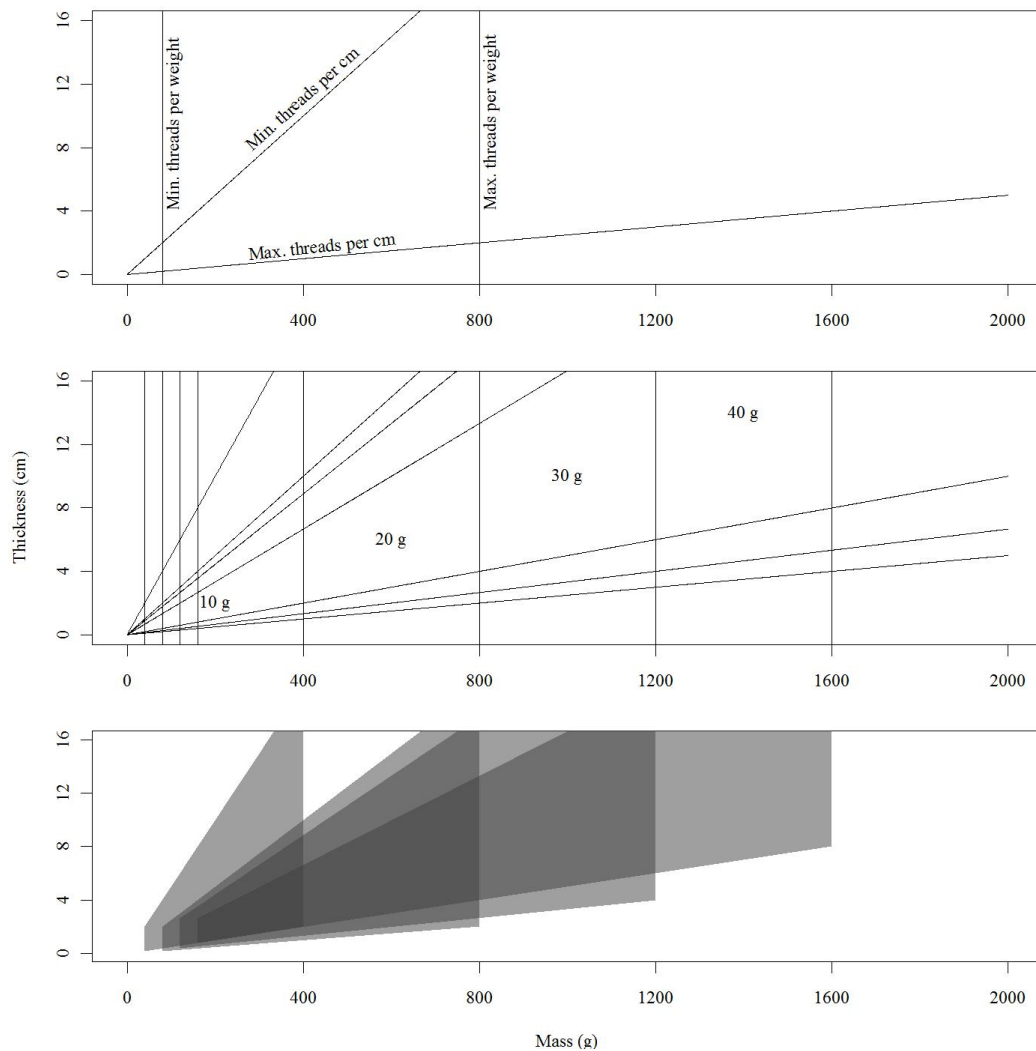


Figure 1.1: Limits of Possibility for Textile Production Given Loom weights

Top: the limits that constrain loom weights when weaving thread that requires 20g tension. The vertical lines are the limits due to the maximum and minimum thread counts per loomweight, which are calculated by dividing the mass of a weight by the tension. The diagonal lines represent the maximum (lower line) and minimum (upper line) warp threads per centimeter in the fabric, which is more usefully expressed as the minimum or maximum width of a loomweight given its weight and the tension required per thread. The upper bound is a hard boundary, in that it is important for defining the maximum size of a weight; the lower bound, however, is more permeable, as the width of a loomweight can easily be increased by not requiring loomweights to touch each other, or by attaching a rod to the loom weight.

Middle: the limits that constrain loom weights for 10g, 20g, 30g, and 40g tension. Labels indicate part of the possibility space associated with each type of thread, with the maximum mass per weight being the next to the right.

Bottom: the possibility space for 10g, 20g, 30g, and 40g tension with overlaps shown in progressively darker colors. Small and light loom weights prove to be the most versatile, while either thick or heavy loom weights are associated with more distinctive types of fabric.

that suggested at least some planning for the storage of different foods such as grain, olives, and wine.¹⁵ She further noted that a separate decorative style correlated with each type of manufacture that visually marked the contents. Decorative style may be useful in identifying the contents of vessels, but given the social importance of these features for presentation and status building this may be confounded in practice.¹⁶ The physical properties of vessels remain a possible means to determine the intended contents.

The types of food kept in storage can be influenced by decisions concerning time management for food processing, status, and the use context for the storage (primary versus secondary).¹⁷ Status-based food hierarchies, such as the relative proportion of barley and wheat, can calibrate notions of eliteness for a given context.¹⁸ The closeness between storage and cooking spaces also informs the relative importance of access versus presentation in daily use, and may relate to political elements of storage as well as social processes of display.¹⁹ How such processes relate to the style and iconography of pithoi needs further examination in this light.²⁰ Many of the social dynamics behind storage are lost, as they would play out temporally in terms of bread sharing and grain loan arrangements rather than in spatial or contextual variation of different foodstuffs.²¹

Food processing

Food processing required almost as much labor as textile production. Processing grains and pulses would have been a daily affair, as most grain was stored whole and, in the case of barley and glume cereals, often as spikelets.²² Barley and glume wheats were separated by pounding grains on tall standing mortars or flatter slabs, while flour for bread was produced using either spherical or elongate hand grinders on saddle querns.²³ Barley may require roasting before grinding, and

¹⁵McLoughlin 2011.

¹⁶Ebbinghaus 2005.

¹⁷Halstead 2014: 183; Welch and Scarry 1995..

¹⁸Halstead 2014: 181.

¹⁹Garnsey and Morris 1989; Ault 2007; Haggis and Mook 2011: 378.

²⁰Ebbinghaus 2005.

²¹Halstead 2014: 165; 298.

²²Halstead 2014: 183.

²³Curtis 2001: 264-5; 280-281.

thus may appear as whole grains in hearths where it is being processed, or as carbonized remains in broken fragments around querns with evidence for pounding.²⁴ Most grindstones associated with grain production in the Archaic period, at least at Morgantina, appear to be saddle querns with use-marks from palindromic motion, while earlier local querns use spherical to sub-spherical hand stones in a circular motion, the former making more efficient use of the hand stone.²⁵ Tool form and wear patterns from grain processing thus may distinguish efficiencies in production as well as technological traditions (see sec. ??).

Pulses such as lentils and peas are largely hand-picked and sorted because of the fragility of the crop, and stored cleaned yet whole.²⁶ These could be further processed by splitting the lentils or peas on a mortar or grinding them into flour.²⁷ The same percussive and grinding marks on stone tools can result from the preparation of grains. This makes tool sets harder to specify as to a specific use, and increases the ambiguity in interpreting tool sets.

The production of wine and oil on a variety of scales often requires specialized equipment for the handling and separation of liquids as well as methods for extracting liquids from fruits.²⁸ Oil production can occur on a very small scale, using primarily mortars to break apart olives and small vessels to separate the oil and water.²⁹ Such small scale production leaves a characteristic mix of whole and broken olive pits, although the latter can also appear in deposits because of their use as fuel.³⁰ Wine is generally produced on a larger scale and requires more specialized equipment in order to press the grapes. This equipment can include vats with spouts as well as treading areas and large channels or basins larger than 1 m³.³¹ These features can indicate domestic or larger scale production, and require further evidence to distinguish between the two contexts. More elaborate presses and weights appear to be associated with industrial production, however.³²

²⁴Curtis 2001: 279.

²⁵White 1963.

²⁶Halstead 2014: 78; Sarpaki 1992; Jones 1987.

²⁷Sarpaki 1992.

²⁸Foxhall 2007a: 131-8.

²⁹Brogan et al. 2013; Frankel 1999: 59; Foxhall 2007a: 213-7.

³⁰Brogan et al. 2013.

³¹Frankel 1999: 57.

³²Frankel 1999: 67.

Food Preparation

Cooking has become an observable phenomenon in recent scholarship. Residue analysis has become increasingly popular as a means to determine the foods prepared in specific vessels.³³ More generally, the diversity of vessel forms as well as soot marks from cooking and baking have allowed the reconstruction of cooking sets even without extensive scientific testing, and allow us to correlate different forms with different dishes, ingredients, or modes of preparation.³⁴ These can be imbued with symbolism or ideological meaning in certain contexts and thus transmit valuable social information when clear trends are detectable.³⁵

Food consumption

Eating and drinking on a small scale are generally assumed to indicate domestic space, while dining that is marked by its quality, recurrence, or large scale has been interpreted as evidence for feasts and public or communal spaces such as *andreia*. Extensive work on the contexts and dynamics of feasting have identified two major modes of dining, competitive and communal, as well as several different purposes, including differentiation, labor mobilization, and the acquisition of asymmetric social prestige.³⁶ The contrast of these two dining modes is between the internal actions and behaviors while dining, not between broader societal and physical contexts. These internal social dynamics depend on the diacritical or integrative nature of the acquisition, preparation, and presentation of food as well as the organization of the dining space and the types of vessels used. Public and private contexts are generally distinguished in these two cases by further evidence such as mixed used space or monumental scale, and may relate to why different strategies were chosen, but do not directly correlate with the goals or results of feasting.

Competitive dining takes place between elites who are seeking power or status over others at the feast.³⁷ Highly elaborated ceramic forms with different designs help distinguish each mem-

³³Roumpou et al. 2013; Tiverios et al. 2013; Sarpaki 1992.

³⁴Hally 1983, 1986; Griffiths 1978; Borgna 1997, 2004a.

³⁵Borgna 1997, 2004a; Yasur-Landau 2006.

³⁶Dietler 2001; Hayden 2001; Phillips Jr. and Sebastian 2002; Borgna 2004a.

³⁷Phillips Jr. and Sebastian 2002; Wright 2004.

ber of the feast, while iconography and inscriptions are often personally directed at individuals across the room, resulting in interactions between pairs of people without reference to the group collectively.³⁸ Drinking games, the use of imported vessels, and the consumption of meat or other labor-intensive agricultural products promote an elite ideology that concentrates on excluding others while also flaunting the accumulated wealth of an individual host.³⁹

Communal dining aims to create an egalitarian group identity by subordinating individuals to a collective interest.⁴⁰ Although food may be provided by individuals or sub-groups, the participation in a single act of consumption in an open or publicly accessible place frees the feast from overt connotations of personal wealth.⁴¹ Large and elaborate communal vessels for serving coupled with standardized and simplified bowls for individuals focus attention on the act of commensality and thus establish the group as a unit.⁴²

These strategies can be combined and expanded to account for subgroups or personal motives, but these variants can only be identified with more information on the context of feasting. Competitive dining appears to be easily formalized, and in small contexts such as *androne*s may in fact serve to build group identity through its exclusionary treatment of outsiders.⁴³ Conversely, parallel rooms for communal dining that use different equipment (e.g., metal instead of ceramic vessels) can serve to distinguish between groups within the larger community, as the distribution of kylikes at Pylos suggests across its many halls.⁴⁴ Feast-hosting may also try to encourage communal identity subordinate to a single elite or elite group in order to increase their power and status, but this practice is likely to be difficult to detect without specific finds that inform provisioning and supply chains.⁴⁵

These dynamics can be distinguished using a variety of correlates. In terms of vessels, elite competition generally requires elaborate ceramic forms that use bidirectional iconography and a

³⁸Borgna 2004a,b; Lynch 2011; Pollock 1983; Hayden 2001.

³⁹Wright 2004; Fox 2012; Borgna 2003.

⁴⁰Hayden 2001; Phillips Jr. and Sebastian 2002; Bendall 2004.

⁴¹Dietler 2001; Yasur-Landau 2006; Lang 2007.

⁴²Rutter 2004; Borgna 2004a,b.

⁴³Wright 2004; Lynch 2007.

⁴⁴Bendall 2004.

⁴⁵Phillips Jr. and Sebastian 2002; Whitley 1991; Haggis 2013a.

widely heterogeneous style in terms of symbols, colors, and narrative stories. The standardization and comparative austerity of communal dining wares make each vessel similar to the others, although serving vessels such as kraters may retain elaborations and complex iconography. As the scale of dining is partially correlated with the internal dynamics, evidence for the number of people participating in feasts is also useful. In intact deposits, the ratio of serving vessels to cups or bowls, either by number or volume, reflects the mean size of groups.⁴⁶ The size of a space as well as its public or private status can also contextualize these dynamics. Further, the choice of food often has status associations, such as the hierarchy of grain types observed for the Aegean, and can be correlated with variation in ceramic forms to calibrate these interpretations.⁴⁷

Larger scales of dining require a greater percentage of the community to participate, while smaller scales limit the number of consumers who can be present. Combining this simple observation with the modes of interaction detailed above, dining forms a powerful motivator and container for social interaction across a site, with immediate consequences for social structure.

1.2 Economy in the First Millennium BCE Aegean

The economic information that can be recovered from archaeological contexts enables interpretations of the scale, communality, and status associations of different activities when compared with other material. Scholars so far have primarily used such data to discuss the specialization and differentiation of economic functions. These terms are not well defined, and often scholars vary in terminology to refer to the spaces and people conducting sets of activities with different degrees of spatio-temporal overlap and frequency. For the sake of establishing a convention for useful summary, I define **specialization** as *a single economic activity that an individual carries out most of the time*, while I use **specification** to refer to *the use of a given space or type of space for a certain set of activities*. Thus specialization is a phenomenon of a person, regardless of the space they are in, while specification is a property of space, regardless of the people in it. I draw this distinction

⁴⁶Whallon 1969; Turner and Lofgren 1966.

⁴⁷Welch and Scarry 1995; Hamilakis 2000; Halstead 2014: 181.

so as to isolate the two trends as far as is possible.

The functional specification of Greek spaces increased from the Early Iron Age to the Hellenistic period. The articulation of space has been well documented at Oropos by Mazarakis-Ainian, who notes more formalized borders around property and the construction of separate functional spaces starting in the eighth and seventh centuries.⁴⁸ The compounds at Oropos are associated with elite families and clearly distinguish rooms for feasting, metal working, and storage within these compounds, and contrast with the living-storage duality of sites such as Nichoria.⁴⁹ In the Classical and Archaic periods, elite houses use more rooms and focus activity within specific loci, gradually establishing canons that have been classified into typologies by modern scholars.⁵⁰ In smaller houses, spaces are not so well differentiated: multiple functions co-occur often, and built features such as hearths and stoves may be replaced with movable objects to allow alternate uses of space beyond cooking.⁵¹

On a larger scale, trends in urban morphology point to the construction of distinctions between urban and non-urban space by building city walls.⁵² Clear distinctions are further drawn between domestic and communal spaces during the Archaic period through the formalization of settlement plans.⁵³ The identification of specific production quarters on the fringes of towns, however, has largely proved elusive, and attestations of their existence stem largely from the overly literal interpretation of literary sources.⁵⁴ A significant variety of domestic industries, ranging from metal working to weaving and coroplasty to marble carving, has demonstrated that the trends toward differentiation between uses of space are not as great on the level of the settlement as they may appear based upon house typology.⁵⁵ These trends continue into the Hellenistic period, when shops are associated with houses adjacent to them that contain concentrations of artifacts significantly

⁴⁸Mazarakis-Ainian 2007.

⁴⁹McDonald et al. 1983.

⁵⁰Ault 2007; Nevett 1999: 65-72.

⁵¹Foxhall 2007a; Lynch 2007; Tsakirgis 2007; Nevett 1999: 76-7.

⁵²Danner 1997; De Polignac 2005; Crielaard 2009.

⁵³Lang 2007.

⁵⁴Cahill 2005.

⁵⁵Cahill 2005; Tsakirgis 2005; Nevett 2005.

greater than expected for household production.⁵⁶ Even as houses grow more complicated and articulated, at least for elites, there is little evidence for the increasing economic specification of space on the scale of settlements.

The same finds of domestic industry point to degrees of specialization within settlements by the Classical period, as some houses had the equipment to produce sufficient materials for sale or trade, and may have exclusively worked on products rather than household maintenance and subsistence. Specialization is difficult to detect archaeologically, and is largely discussed only after the appearance of written sources in the Classical and Hellenistic periods. Specialization explains the rise of domestic industry, and why no clear patterns on the level of the settlement indicate economically specified areas, as specialization varies among houses but with no predictable relationship between location and specialty.

Little evidence has been published for specialization in the Archaic period, although houses are already more complex and some settlements use planned streets by the middle of the 7th century.⁵⁷ Perspectives on this vary. Agricultural specialization or pastoralism may have become more important during the Early Iron Age, but the evidence is far from definitive.⁵⁸ Either of these would leave little trace beyond bones and burned botanicals, which makes detection impossible at many sites.

1.2.1 Social Implications of Economic Trends

The consequences of many of these trends have not been treated well in the literature. Increased specification within houses would require more movement between rooms, creating more contexts for interaction as well as increasing the intimacy and privacy of activities segregated to the sides and backs of houses.⁵⁹ Specification would also make the organization and articulation of spaces important rather than just the arrangement of movable objects and activities within a room. Domes-

⁵⁶Vogeikoff-Brogan 2011; Cahill 2005.

⁵⁷Danner 1997.

⁵⁸Snodgrass 1987; Foxhall 1995; Palmer 2001.

⁵⁹Mustafa et al. 2010; Nevett 1999: 10,30-33.

tic specialization would notably affect social relations as well as the modes by which a household interacts with external groups such as neighbors, family, and foreigners. Specialization would also increase the amount of socially relevant information required for each individual and the scales of cooperation individuals were regularly involved in. Cahill discusses these effects in a household in Sardis, where multiple family groups appear to have cooperated within a single domestic context in his case study, each participating in the industry as well as daily life of a large house.⁶⁰

Clear from the discussion of archaeological evidence above is how common such instances of cooperation must be, even if not always detectable archaeologically. Labor sharing and collective working events probably preceded formal specialization.⁶¹ For a square meter of a fine cloth, over 100 hours had to be spent on the spinning, with an additional minimum of 60 hours spent weaving, but cooperating with one other person just on passing the shuttle back and forth would reduce the weaving time requirements to 40 hours, while two nights of collaboration on the spinning could provide the thread.⁶² Grinding grain for daily bread required three hours a day in Halstead's ethnographic work, but could co-occur with other family members or families to more efficiently divide labor between agricultural and domestic tasks.⁶³ A variety of social institutions associated with labor sharing in agriculture could have enabled complex agreements lasting years among farmers.⁶⁴ In addition to tracing groups and social interactions through style and iconography of objects (see sec. ??), the functional record of activities can help us infer how people interact in different contexts, and how these may comprise a social fabric of a settlement. This is an element often considered in ethnographic work, but has not yet been well theorized in interpretive contexts or consistently applied

⁶⁰Cahill 2005.

⁶¹Dietler and Herbich 2001; Halstead 2014: 308-9.

⁶²Mårtensson et al. 2009, 2006a.

⁶³Halstead 2014: 183.

⁶⁴Halstead 2014: 41, 100-104, 110-111, 121.

1.2.2 Conclusion

Our economic picture of urbanization across the Early Iron Age, Archaic, and Classical periods thus broadly points to smaller mixed-function houses comprising villages becoming large differentiated complexes in architecturally delimited urban environments. Given the evidence that has been presented, several expectations arise for the Archaic city.

- Specification should be a trait present in houses while specialization should not, arising instead in the Classical or Hellenistic periods.
- The plan of a city should reflect distinctions between city and country, public and private, but not domestic and industrial.
- Social interactions would have taken place in different locales as specification alters the living organization of houses.

These expectations will appear again later. For now, I turn to social organization and previous approaches to inferring social systems from archaeological data.

Chapter 2

Material Evidence for Social Organization in Settlements

Social organization is not directly recorded in the archaeological record.¹ Multiple approaches exist for inferring social organization from material evidence, however. This section treats the body of theory that uses archaeologically observable material to infer dynamic social processes that appear in ethnographic, anthropological, or literary parallels. It then discusses narratives of social change and organization in the first millennium BCE Aegean to contextualize the Archaic period and define what problems remain.

2.1 Social Groups from Objects

Material culture shapes and reflects social processes, but does not record behavior or thought like an ethnographic account.² Individuals communicate through material culture, which as a whole forms a behavioral system that can be inferred from the permanent changes to objects and places.³ Behavioral systems range from scales describing cultures and communities to individuals and kin

¹Dietler and Herbich 1998.

²Morris 1998; Small 1998a,b.

³Schiffer 2002: 15-19, 59-65.

groups, and are inferable across this range.⁴

The phrase “social organization” implies a structure composed of actors and connected by relations. The dominant paradigm behind most methods of social inference assumes that individuals belong to a set of overlapping, non-exclusive groups that interact through specific formalized contexts. Boundaries that separate groups are assumed to be identifiable in material culture by comparing assemblages between groups. This has largely been the historical approach to understanding archaeological cultures as ethnic groups, although has more recently been used at sub-ethnic levels as well.⁵

It is unclear, however, that material boundaries correlate with social boundaries.⁶ Given the conscious manipulation of visual style as a communicative medium, differences may be mitigated or exaggerated depending upon the traditions, attitudes, and goals of producer and consumer groups.⁷ Two approaches have emerged to deal with this problem: consumption-based approaches, which embrace this manipulation as the material expression of communication in a culturally specific context; and production-based studies, which seek elements of technical style that have sufficient variability to be useful to the archaeologist yet are improbable media for visual communication.

2.1.1 Production Studies

Technical style determines the choices made in processes of production and assembly.⁸ The series of production tasks for an object varies among groups in ways that lead either to identical products via different procedures (*isochrestic variation*) or into different products for identical purposes.⁹ Variations in the *chaîne opératoire*, or production pathway, that result in functionally equivalent products are determined by culturally reinforced modes of doing, also known by Bordieu as the

⁴Schiffer 2002: 20-23.

⁵Maceachern 1998; Attarian 2003.

⁶Stark 1998a; Goodby 1998.

⁷Dietler and Herbich 1998.

⁸Stark 1998a.

⁹Chilton 1998; Plog 1995.

habitus.¹⁰ The *habitus* is an abstract template of behavior that prescribes ways of doing, in part formally learned and in part reinforced through social interactions with others.¹¹ Through this framework, the transmission of knowledge relates production to social groups.

Following Dietler and the French tradition of technological analysis, comparison of the *chaîne opératoire* for a given type of artifact across a region has enabled identifications of how learning communities, the groups of people who pass on technical knowledge, relate to ethnic and cultural groups.¹² Comparison of variation within the *chaîne opératoire* for a given object has generally been confined to recognizing social groups that span across multiple communities. Differences in ceramic production and architecture divide regions into overlapping groups, but settlements are almost always treated as consistent wholes.¹³ In the Aegean, Knappett has successfully applied this technique to ceramics in Middle Minoan Knossos to detect social distinctions between Knossos and surrounding communities.¹⁴ By tracing the adoption of wheel throwing and wheel fashioning through time, he finds greater differences in socio-technical background within Knossos than within other settlements. Studies of *chaîne opératoire* can apparently classify diversity within a community, even though his approach was limited to a single form of evidence with strong limits on what stages can display isochrestic variation.¹⁵

Comparison across forms of evidence can broaden the utility of production studies, although the requirements of isochrestic variation and a lack of meaningful communication can be very limiting. This last requirement in particular can be difficult to validate. For a brief example, Cameron treated architecture in the North San Juan area as a significant yet passively designed system for indicating group identity, and thus usable in *chaîne opératoire* studies rather than signaling or consumption.¹⁶ Moore and Jacobs have each discussed the potential for active symbolism in construction styles, and more recently Ortman argued that architecture in the same region was influenced

¹⁰Dietler and Herbich 1998; Plog 1995; Trigger 1991.

¹¹Welsch and Terrell 1998; Goodby 1998; Hegmon 1998.

¹²Stark 1998b.

¹³Cameron 1998.

¹⁴Knappett 2004.

¹⁵Braun 1983; Dietler and Herbich 1998.

¹⁶Cameron 1998.

by a deliberate recasting of new societal metaphors onto buildings.¹⁷ The meaningful and non-meaningful properties of material are not universal in different cultural contexts, and require some form of evaluation before production studies can be useful.

2.1.2 Consumption Studies

Visual variation enables viewers to assign symbolic meaning to apparent differences.¹⁸ Individuals can alter physical objects to display and symbolically emit certain messages.¹⁹ This transmitted information can be critical in marking homogeneity and differences within and among groups, and can reflect conscious choices about identity.²⁰ Visual communication systems are often directly relevant for archaeological studies, as many contexts contain objects used but not manufactured in them and mechanisms of distribution can obfuscate the communities of learners identifiable through production analysis.²¹

Ceramics preserve such elements of visual style and convey symbolic information across multiple dimensions of variation, such as motifs, decorative techniques, and iconography. In this context, information is a reference to meaning derived from context and association.²² These stylistic approaches are consistent with the definitions of information theory and signaling games.²³ Information-theoretic frameworks have often been used in archaeology and oversimplified to interpret symbols on pots as somehow having inherent meaning in themselves.²⁴ Such interpretations ignore how visual style functions as a communication system. Information and meaning are relative to the prior beliefs and contextual expectations of the viewer; moreover, meaning is continuous and fluid despite the use of discrete symbols.²⁵ Symbols themselves are conventions

¹⁷Moore 1996; Jacobs 1961; Ortman 2012.

¹⁸Pollock 1983.

¹⁹Schiffer 2002: 51-3.

²⁰Attarian 2003; Cowgill 2003; Smith 2003a; Meadows 1999.

²¹Gosselain 1998; Dietler and Herbich 1998.

²²Plog 1995; Pollock 1983.

²³For human communication systems see Shannon 1948; Skyrms 2010; Schiffer 2002: 67-8. For broader texts on information theory see MacKay 2003; Cover and Thomas 2006.

²⁴Dietler and Herbich 1998.

²⁵Shannon 1948; Skyrms 2010: ch. 1.

that can emerge from repeated interactions and the background of viewers.²⁶ Information and communication-based frameworks for ceramics and other objects can recover useful patterns, but only when interpretation of these concepts retains the limits and assumptions of the underlying theories.

Considering variation in symbols and visual style in archaeological material has enabled divisions to be identified at the level of individual contexts or archaeological deposits, where divisions separate context-specific social groups.²⁷ Bendall identified differences in the distribution of metal and ceramic kylikes and correlated these distinctions with accessibility and the size of the space to argue for stratified feasting at Pylos.²⁸ Rather than treating these as correlations, however, Bendall focused on the signaling potential of the material differences to create a compelling argument for status markers. Such analyses crucially bridge the gap between statistical analysis and the identification of mechanism in their treatment of the data.

Style remains important for understanding consumers' constructed differentiation. Whether the detectable distinctions reflect structures on the scale of ethnic groups or archaeological cultures is not well explored.²⁹ Finer-scale variation within communities, however, establishes the utility of the concept.

2.1.3 Production and Consumption Groups

The inferred social groups of production and consumption studies are confounded. The learning context is essential for the cultural replication and transmission of the *habitus*, as a learner infers this through active feedback and broader social pressure.³⁰ Little work has tried to identify the learning context archaeologically, as ethnoarchaeological studies generally focus on small-scale societies where the house is the dominant center of production. Langdon's work on children in Early Iron Age Greece has identified several ways to detect child learners through specific types of

²⁶Barrett 2007, 2006; Schiffer 2002: 59-65.

²⁷Lynch 2011; Bendall 2004; Haggis 2007.

²⁸Bendall 2004.

²⁹Goodby 1998.

³⁰Dietler and Herbich 1998.

errors in the manufacture of pottery and bronze figurines.³¹ Many child-made items occur at sanctuaries with assemblages from workshops and were likely the products of a very different learning context than the household. A broader application of this work in conjunction with *chaîne opératoire* studies could advance these methods and better tie in the reconstructed production community with real spaces and social groups.

Consumption studies would also benefit from an active consideration of learning. Symbolic systems may be learned easily with repeated exposure, and likely use similar mental capacities to language, which is generally easier for children than adults.³² Meaning is context dependent, and each individual may learn different associative networks of meaning. A better understanding of how people learn these systems and conceptualize them would greatly benefit stylistic analysis and could be developed by integrating linguistics and psychology with the communication and learner/*habitus* paradigms. Unifying spatial, social, and psychological contexts should remain a goal for reconciling the external signaling and internal *habitus* of these presently disjoint fields.³³

2.2 Houses to Households

The methods discussed above inform broader relationships between material and society, starting at the scale of the household. The household is a kin group that shares living space and interacts on a regular basis. Kin, however, may be fictive or real, the spaces may be contiguous or disjoint, and interactions may vary greatly in intensity, duration, context, and purpose even among the members of a single household.³⁴ Households are therefore not houses.³⁵ Households are inferences, only apparent through their multi-functional use and organization of space as well as the symbolism they choose to imbue their houses with.³⁶ Through a recognition of generative social mechanisms for the material record, archaeology can study social processes beyond the constraints that logical

³¹Langdon 2013.

³²Skyrms 2010: ch. 8.

³³Trigger 1991.

³⁴Alexander 1999; Souvatzi 2008: 9-10.

³⁵Gillespie 2007.

³⁶Beck Jr. 2007; Alexander 1999.

positivism would otherwise place.³⁷

Houses remain fundamental units for archaeology because of their relation to households. Physical definitions of social groups are favored in order to facilitate archaeological inference, even if not always justified ethnographically or historically. For example, some households control multiple buildings; similarly, individual buildings may contain communal spaces beyond the ownership of the household, as in the case of porches or courtyards in housing blocks.³⁸ Space remains a critical dimension of the household, however: learning, production, and consumption contexts are unified by interactions within houses.³⁹

Houses are often recognized through a core domestic assemblage, a culturally specific set of norms that excavators consider in identifying buildings.⁴⁰ Houses are understood to contain certain activities such as storage, food preparation and processing, eating, and various forms of domestic production such as spinning, weaving, and ceramic production. This list is not sufficient on its own, but in most contexts excavators use this type of mixed functionality in a building as evidence for a house. Deviations in the quantity and type of material are interpreted as indications of socioeconomic strategies and practices.⁴¹ For example, weaving for purposes beyond domestic consumption is assumed when loom weights appear in greater numbers than in other houses for the same culture and time period.⁴² The problem of house identification is largely recursive, depending upon previously identified buildings and leading to difficulties when new areas or periods are investigated.

Once identified, more approaches exist to conceptualize and interpret houses. Behavior and interactions are constrained by architecture and indicated by artifacts. Interpretations of architecture generally relate to possibility, or constraints on what can be done in a space, while interpretations of artifacts are based on likelihood and correlations between behavior and material remains in a

³⁷Lawrence 1999; LaMotta and Schiffer 1999.

³⁸Sjögren 2007; Cowgill 2003; Mook 2011.

³⁹Beck Jr. 2007; Souvatzi 2008: 16-8, 28-9.

⁴⁰Souvatzi 2008: 14-9.

⁴¹Souvatzi 2008: 34-6.

⁴²Sofianou 2011.

given location.⁴³ The former are more robust because of the fundamental perceptual constraints that buildings place on human interaction as well as their preservation, while the latter are more likely to be skewed by depositional and taphonomic processes.⁴⁴

Architecture

Architecture limits the visibility and audibility of human interactions.⁴⁵ Many approaches to understanding these effects have been qualitative, based on the visual analysis of plans and informal considerations of lines of sight.⁴⁶ 3-D modeling can provide qualitative approaches with better visualizations of plans, although almost no instances exist of using these models to implement known human perceptual limits, focusing instead on generic phenomenological impressions.⁴⁷ Access analysis and isovist maps, in contrast, have quantified the spatial limits on interactions by considering the visibility and access to spaces in houses.⁴⁸ Access analysis comes from space syntax and uses the topology of spaces to determine probable routes of entry and movement, illuminating the structure of traffic within a building or settlement. Isovist maps quantify the overlapping visual fields of viewers and allow directional interpretations of intervisibility. These factors, visibility and the amount of potential traffic, allow privacy and intimacy to be built permanently into the use of spaces and interpreted as such, although temporary barriers and behavioral patterns can achieve these effects in archaeologically undetectable ways.⁴⁹

Beyond these constraints, architecture limits the range of activities given free space, ventilation, light, and humidity.⁵⁰ Lack of direct and indirect light limits the use of space for production and interaction, although these constraints can be partially overcome by movable light sources in some cases.⁵¹ If interactions or activities are impossible in certain spaces, valuable information is gained

⁴³Small 1998a.

⁴⁴Fletcher 2007; Moore 1996: ch. 1; LaMotta and Schiffer 1999.

⁴⁵Fletcher 2007.

⁴⁶Nevett 1999: 30-3.

⁴⁷Sturt et al. 2007; Fitzjohn 2007. Such limits have been identified and applied archaeologically, but never in a computational framework; see Legge et al. 1985; Kaplan 1986; Moore 1996.

⁴⁸Nevett 1999; Romanou 2007; Turner et al. 2001; Moore 1996: ch. 5.

⁴⁹Mustafa et al. 2010; Nevett 1999: 30-33.

⁵⁰Mann 2015; Sturt et al. 2007.

⁵¹Parisinou 2007.

in the form of “true-negative” evidence, a rarity in archaeology and essential for making use of the other major source of information, artifacts.

Artifacts

Different activities inferred from assemblages can characterize the behaviors of households in houses.⁵² A diverse range of anthropogenic and environmental processes affect movable objects before their ultimate deposition, some of which leave definite marks and some of which spatial and relational context imply. The confounding effects of use, abandonment, recycling, and decay with differences in behavior and activity in spaces make precise reconstruction on the basis of visible artifacts difficult.⁵³ Reuse can generate archaeological contexts identically to systemic use, and unrelated functions may be confused because of the temporal context of activities throughout the day and over the history of a building.⁵⁴ Attributing abandonment debris to ritual activity, preservation biases, or inconclusive variability clearly does not work for all cases: discrete and thematic assemblages are found relationally adjacent within rooms, and variation in assemblages among rooms can correlate with architectural limits and immovable built features.

Deterministic and simple interpretations of such finds have led to the oversimplification of many multifunctional spaces.⁵⁵

Identifying depositional and postdepositional processes remains critical to effectively interpreting artifacts in houses. Assemblages contain valuable information about generative process, and many excavators have identified abandonment and taphonomic biases on the basis of types of material preserved and their conditions. Architecture in this case can give an independent means of assessing the processes affecting assemblages. Objects found in spaces where they could not be used on the basis of architectural constraints have clearly been removed from their use contexts by storage, abandonment, or taphonomic effects. In extending artifact and activity analysis to households, considerations of process must thus precede analysis of function, but need not dwarf all

⁵²See chapter 1.

⁵³LaMotta and Schiffer 1999; Souvatzi 2008: 19; Nevett 1999: 29.

⁵⁴McKee 1999; Alexander 1999; Goldberg 1999.

⁵⁵Foxhall 2007a; Nevett 1999: 51-2, 51-2, 69; Mann 2015.

social interpretations under the auspices of environment and ritual.⁵⁶

Typology and Organization

Houses require comparison to one another to identify them.⁵⁷ Yet multifunctional spaces and the difficulties with defining houses challenge the ability to consider a house in any context beyond its own.⁵⁸ Archaeologists can compare architecture and assemblages, as well as implied activities, among houses by constructing classificatory typologies.⁵⁹ Classification schemes that use divisions such as kitchens, storerooms, and work spaces simplify the complexity of an assemblage by mapping groups of objects into a more comprehensible system with fewer degrees of freedom. These methods allow houses to be projected into a single descriptive framework, but can gloss over variations such as the actual life history of a house and the differences between archaeological and emic ideas of space.⁶⁰ Souvatzi critiques typologies as a whole, but projects context-specific assemblages onto groups of related functions and only later compares them in a spatial context; in my view, this is still a classification scheme, but one that uses activities as divisions and ignores spaces below the scale of the house.⁶¹ Archaeological data are simply too complicated to compare without a form of simplification. By intelligently choosing simplified representations, an archaeologist may glean a less biased or prescriptive view of the material, although interpretations will always be theory-laden.

Once a classification method is established, frameworks exist to elucidate patterns and underlying structure in houses. Space syntax examines the relational structures among classified parts: simplified relations such as adjacency and centrality are informative in their own right, as they identify social and cultural characteristics of households.⁶² The accessibility and visibility of different functions within the house can indicate associations with gender, dependency, and other social

⁵⁶cf. LaMotta and Schiffer 1999.

⁵⁷See pg. 25.

⁵⁸Souvatzi 2008: 46.

⁵⁹Fiedler 2005; Nevett 2005; Romanou 2007; Sjögren 2007; Haggis and Mook 2011; Nevett 1999: 26-7.

⁶⁰Foxhall 2007a; Souvatzi 2008: 34-5.

⁶¹Souvatzi 2008: ch. 4, 112-114, 154.

⁶²Explicitly in Romanou 2007, implicitly in Haggis and Mook 2011.

attributes.⁶³ Without knowing a priori what functions are associated with specific groups of people, these inferences remain distinctions of degree and co-occurrence rather than identifications of unique groups.⁶⁴ House organization treated more generally can reflect symbolic connections between the household and house in terms of absolute and relational orientation.⁶⁵ These simplified analyses illuminate behavioral and cultural patterns on a scale suitable for comparative analysis, despite concerns of useless oversimplification.

The core assumption behind most of these methods is that emic differences archaeologically delimit social groups by their etic representations; in Hillier's biological metaphor, a house is the phenotypic external expression of an underlying internal genotype to be inferred and contrasted as a useful criterion.⁶⁶ Behavioral and cognitive associations within houses affect learning and consumption contexts and are integral to understanding cultural reproduction and transmission in a process-based manner that goes beyond correlations and identifies mechanisms. This is an aspect of household analysis that typological simplifications will distort and a free-form approach with less comparative power will facilitate. Fundamentally the generative elements of culture are strongly affected by historical contingency and detailed associations, while the learned elements of culture are formed by pattern recognition and inference.⁶⁷

Typologies of houses have been used in multiple instances across the Aegean to discuss social and political ideology such as egalitarianism and communality in the archaeological record.⁶⁸ Correlating typological categories with ideology ignores the theory-dependency of simplification schemes and tries to create inherent, emic notions out of the archaeologists' tool set. Inferring emic representations of houses through a suite of comparative frameworks approaches the symbolic and behavioral associations that affect ideology. It may be possible to use houses to under-

⁶³Goldberg 1999; Nevett 1999; Antonaccio 2000; Coucouzeli 2007.

⁶⁴Lawrence 1999; Castro-Martínez et al. 2013; Nevett 1999: 41-52.

⁶⁵Hodder and Cessford 2004; Beck Jr. 2007; Schiffer 2002: 20-4.

⁶⁶Stark et al. 1998; Romanou 2007; Hillier et al. 1987.

⁶⁷In archaeology: Souvatzi 2008: 19, 205-7; Trigger 1991; Small 1998b; Morris 1998; Small 1998a; Nevett 1999: 29-30; Langdon 2013. In psychology: Kahneman 2011 and most of his bibliography as cited there; this is also one of the implications of Tomasello 2009. In linguistics: Chomsky 1956 and more recent theoretical work such as Gold 1967 discuss the inference side of things, while Everett 2012 has made convincing arguments especially about the role of production and culture diverging in context-specific ways.

⁶⁸Nevett 2007; Nevett 1999: ch. 7; Westgate 2007a,b.

stand higher-order social and political structures, but not without breaking down house typologies into households and people.

2.3 Households to Settlements

Settlements tie the supra-individual household into larger scales of organization.⁶⁹ Integrative and competitive activities moderate or formalize interactions and are critical to the maintenance of communities, ranging from large-scale feasting to the construction of monumental architecture and integrative ritual events. The layout of settlements also reflects and shapes economic and socio-political organization by promoting interactions by the shape and context of space.

2.3.1 Integration and Competition

Social relations can become more fragmentary with urbanization and population growth.⁷⁰ Beyond a certain size, communities need to develop social technologies to handle competition and social tension.⁷¹ Social technologies can emphasize community identity or formalize group divisions by moderating how individuals interact.

Social integration requires the unification of the community through the recognition of a higher authority, often notionally collective. Formalizing communal activities such as religious rites or feasting can symbolically differentiate public interactions and build collective identities.⁷² Common norms of behavior and effective means of social enforcement can create shared morals and ideals.⁷³ Standards of behavior affect the reproduction of culture, and cause homogenization of practice across a community.⁷⁴

Architecture applies these mechanisms.⁷⁵ The design of public spaces can drive integration

⁶⁹Gillespie 2007: 41-3.

⁷⁰Zeder 2003; Bettencourt 2013.

⁷¹Fletcher 2007.

⁷²Dietler 2001; Hayden 2001.

⁷³Yaeger 2003; Rodning 2013; Houston et al. 2003.

⁷⁴Lopiparo 2007.

⁷⁵Rautman 2013; Rodning 2013.

through perceptual effects that dwarf the individual and create experiences that make participation enticing.⁷⁶ Private spaces that lack clear delineation from public spaces cause greater social homogeneity by increasing interactions between the sub-group and the group.⁷⁷ Concentrated populations further attract others to join the settlement, at which point integrative mechanisms can assimilate them into the community.⁷⁸

The need for community cohesion can be met up to the sizes of communities that humans can tolerate, but then group differentiation must also become an active force.⁷⁹ Breaking down the community into parts formalizes sub-community group identity and interactions among these groups, simplifying social interactions.⁸⁰ Groups can be organized into hierarchical or nested social structures that have variable authority or status within the settlement.⁸¹ Feasts and rituals can be used to negotiate power differences, establish inequality, and create strong social boundaries or ties of indebtedness among groups.⁸² Broader social metaphors and paradigms such as authority resting with first arrivals and undischageable social debts associated with more recent or smaller groups further serve to socially reinforce and define divisions.⁸³ Neighborhoods also reinforce these structures, resulting in further hierarchies and heterarchies of clans or neighborhoods.⁸⁴ Such segmentation can also be entirely artificial and reflect imposed rather than perceived social boundaries.⁸⁵

2.3.2 Structured Space

Similar approaches to the spatial structure of a house can apply to the settlement as a whole given the reflection between architecture and behavior discussed above. Studies of architecture generally

⁷⁶Smith 2003a; Moore 1996: ch. 3-4.

⁷⁷Driessen 2009.

⁷⁸Duffy et al. 2013.

⁷⁹Düring 2013; Fletcher 2007.

⁸⁰Attarian 2003.

⁸¹Düring 2013; McIntosh and McIntosh 2003; Moore 2003.

⁸²Dietler 2001; Hayden 2001; Clarke 2001.

⁸³McIntosh and McIntosh 2003.

⁸⁴Düring 2007; Cowgill 2003.

⁸⁵Davies 1997.

compare the layout of all known houses and are biased toward measurable properties such as area, number of rooms, number of column bases, or distance from communal resources.⁸⁶ Typological approaches to the settlement itself favor the division between planned and unplanned settlements, where the former are often imbued with special social and political meanings. Equal house lots and regular street arrangements are assumed to indicate socio-political equality in planned settlements, and an unequal distribution of house sizes to correlate with inequalities in political and social spheres.⁸⁷ Although these assumptions may make intuitive sense, comparison with other forms of material evidence have challenged these conclusions and suggested the relationship cannot be as simple.⁸⁸ Applications of more holistic approaches to architecture on the scale of the settlement have been rare, although extensions of household analysis have occasionally touched on the composition (and consequent interactions) of a larger community by considering the use and properties of space across the settlement.⁸⁹

In modern urban studies and space syntax theory, settlement morphology has been an essential aspect of discussing the society and culture of cities, although this trend has not been widely adopted among archaeologists.⁹⁰ These approaches have further been linked to the urban phenomenology of Jacobs and Lynch, creating strong theoretical frameworks for analyzing how settlements integrate social groups and the lived experience of individuals by their urban layout.⁹¹ Urban legibility, the ease with which an urban landscape can be understood, plays a critical role in residents perceiving and inferring the organization of a settlement.⁹² Similar to the notion of the *habitus*, legibility is recursively related to both the physical display and space of buildings as well as the internal cognitive structures of individuals. Movement paths affect residents' mental representations of a settlement and how they reproduce urban form and function in their own actions.⁹³ Inferring these patterns from material allows reconstructions of the social organization and

⁸⁶Cahill 2000; Coucouzeli 2007.

⁸⁷Ault 2000; Martinez-Sève 2014; Nevett 2007; Westgate 2007b; Nevett 1999: 1-4.

⁸⁸Cahill 2000; Mann 2015; Danner 1997; Foxhall 2007a.

⁸⁹Romanou 2007; Cahill 2000.

⁹⁰Hillier 2007, 1999, 2012.

⁹¹Seamon 1994; Jacobs 1961; Lynch 1960.

⁹²Lynch 1960; Nevett 2009.

⁹³Hillier et al. 1993.

culture of the communities that produced settlements through the mirroring of internal and external representations.

Settlements are also examined in non-geographic ways that consider the types of spaces without mentioning their place in an urban landscape. This has been a particularly popular approach in considering urbanism, where checklists of urban features are compared among settlements in an attempt to classify social complexity and forms of social organization.⁹⁴ While intuitive, this approach generally makes too many simplifications to construct useful distinctions and inferences without more detailed data.

The methods for inferring social organization from archaeological data span multiple scales of analysis. I now briefly review social developments in archaic Greece before applying these methods to the sites in Crete.

2.4 Social Trends in the first millennium Aegean

Urbanization dominates the history of the Aegean in the first millennium BCE. The emergence of large settlements and the formalization of political systems into various *poleis* has led to extensive work on the definition and exploration of *polis* forms.⁹⁵ The *polis* was a strongly interacting community, often formally bounded in space and with a distinct identity that differentiated it from other communities.⁹⁶ The term hides significant variation among communities, but generally they experienced the combination of integrative and dispersive forces discussed above with varying degrees of success in dealing with them.

The early process of aggregation created urban settlements. During the first half of the first millennium BCE, separate settlements coalesced into polities across Greece, even in regions that lacked the self-defined label *polis*.⁹⁷ Haggis calls these early sets of movable and dynamic settlements “settlement clusters” in his study of the Kavousi area, and evidence for them extends both

⁹⁴Hansen and Fischer-Hansen 1994; Hansen and Nielsen 2004c.

⁹⁵Hansen and Nielsen 2004a; Hansen 2006a,b.

⁹⁶Mackil 2004; Rihll and Wilson 1991; Snodgrass 1991; Whitley 2001.

⁹⁷Hall 2007: 88-90; Cavanagh 1991.

to later periods and other regions.⁹⁸ Distinctive social, religious, and political divisions emerged from these agglomerations: most *poleis* subdivided the population into manageable groups based on concepts such as tribes or original geographic origin.⁹⁹ These divisions are associated with the archaeological remains of previous villages abandoned at the time of nucleation in Hansen's case study, although later uses of the toponyms may not correlate with real kin descendants.¹⁰⁰ This history may be overemphasized in order to impose a natural order onto purely artificial divisions, as emphasized by the association of randomization with the civic subdivisions of the Cleisthenic reforms.¹⁰¹

These divisions are clearly imposed in colonies, which lacked previous Greek settlements to aggregate. The rectilinear plans of colonies such as Megara Hyblaia and Selinous indicate an authoritative control over the layout of the settlement, including the reservation of spaces for particular social and political institutions.¹⁰² Political institutions thus existed from the eighth century on that could strongly influence social organization and promote the notion of tribes or other subdivisions. Planning in most non-colonial contexts is reserved for later periods and is not definitively associated with the emergence of political or social authorities.¹⁰³ In colonial foundations, planning may be a further means to legitimize the *polis* as a natural and ordered entity.

The relationship between population and territory shifted as communities defined themselves and divisions changed in meaning. The decreasing wealth of grave goods and the rise of elite display at sanctuaries led to more emphasis on community ritual and the association of identity with a territory rather than specific leaders.¹⁰⁴ Community integration became an important aspect of civic participation, although elite competition never disappeared entirely.¹⁰⁵ Early social structures based around individual leaders divided people into communities that had rough territorial bounds; *poleis* co-opted and codified existing territories into a broader structure of false-kin

⁹⁸Haggis 2005; Owen 2009; Hansen 2004.

⁹⁹Hansen 2004; Hansen and Nielsen 2004b; Perlman 2014.

¹⁰⁰Hansen 2004; Perlman 2014; Hall 2007: 188.

¹⁰¹Hall 2007: 47-51, 188-190.

¹⁰²Danner 1997; Hall 2007: 80-1.

¹⁰³Cahill 2000; Coucouzeli 2007; Mann 2015.

¹⁰⁴Whitley 1996; Antonaccio 1995.

¹⁰⁵Small 1997, 2009.

tribes with constructed origins while simultaneously formalizing elite networks to serve institutional purposes.¹⁰⁶ Territorial divisions never fully replaced fictive kin structure, although political argumentation evoked them regularly.¹⁰⁷ Personal ties have been assumed to decrease in importance as settlements grew beyond the limits of a face-to-face society, but the continuing emphasis on kin terminology and personal networks suggest that this generalization is not as applicable to the Greek world.¹⁰⁸

Gender divisions became more formalized and subdivided across the first millennium. Based upon the burial record, Whitley reconstructs gender as an axis ranging from the warrior male to undifferentiated children during the EIA in Athens, when women were a poorly defined group in between that incorporated elements of children and adult male burials.¹⁰⁹ Behavioral expectations for men and women diverged by the Archaic period, when men became associated with a public, rational community and women with the private, emotional home.¹¹⁰ Gendered divisions of space and activity were fluid and dynamic depending upon time of day and social context, but became more important as an ideal in the Classical period.¹¹¹ Literary sources increasingly favored strict partitions between masculine and feminine behaviors and spaces, but artifactual and architectural evidence suggest expectations were greater than actual constraints.¹¹²

The evolutionist paradigm of increasing social complexity with population growth does not uniformly explain the social developments of the Aegean.¹¹³ While gender divisions, the formalization of political institutions, and increasing social subdivisions fit such models, the maintenance of personal relations beyond fictive-kin metaphor would not have been predicted. The extension of kin terminology and personal relationships to structure society are one indication of a House society in Levi-Strauss' sense.¹¹⁴ In such a society, the house structures ideology and culture, a

¹⁰⁶Hall 2007: 123-5; Herman 1987: 6-7; Mitchell 1997: 10-3, 22-5; Whitley 1994.

¹⁰⁷Osborne 2012.

¹⁰⁸Garnsey and Morris 1989.

¹⁰⁹Whitley 1996.

¹¹⁰Wees 1998; Rabinowitz 2014.

¹¹¹Antonaccio 2000; Goldberg 1999; Coucouzeli 2007.

¹¹²Nevett 1999: 14-7, 30, 71-2; Antonaccio 2000.

¹¹³Hall 2007; Carneiro 1962, 1967.

¹¹⁴Gillespie 2007; Beck Jr. 2007.

trend identified as early as the Late Bronze Age for Greece.¹¹⁵ Kinship metaphor, an emphasis on the physical house, the indivisibility of ritual and social dimensions from the house itself, and the associations of origins and precedence with the house are all essential to the definition of a House society.¹¹⁶ Neighborhoods and house blocks across the range of Greek settlements divide populations into smaller units in manners that suggest the incremental growth of families and lineages, while such divisions have cross-culturally been associated with kin and fictive-kin groups.¹¹⁷ Such structures survive much later in Greece and are more stable in larger communities than urban anthropological theories expect, as settlements thought of as cities are normally assumed to be beyond the organizational capacity of such a framework.¹¹⁸

These generalizations only apply to a subset of Greek houses and communities. Both Whitley and Haggis construct a dichotomy between stable and unstable settlements on the basis of growth, abandonment, and rebuilding patterns.¹¹⁹ They differ in their definitions of unstable settlements, and insufficient work has been carried out in later periods to determine the full chronological and spatial extent of these trends that are first visible from the end of the Bronze Age. In the Classical and Hellenistic periods, emic ties between the house and family as well as literary and epigraphic metaphors and associations suggest that the House society framework is broadly consistent with the Greek evidence.¹²⁰

The Archaic period witnessed increasing formalization of gender roles and the probable appearance of civic subdivisions. Given the chronological range of evidence for the House society in Greece, the Archaic period likely continued to express common associations between the physical house, kinship relations, origins, and socio-political organization. Integrative mechanisms were already apparent, and elite contacts were still important for how the *polis* functioned, especially in a regional context. I now turn to the sites of interest for analysis.

¹¹⁵Small 1998c.

¹¹⁶Heitman 2007; Beck Jr. 2007; Gillespie 2007.

¹¹⁷Cowgill 2003; Coucouzeli 2007; Glowacki 2000, 2007; Mook 1998, 2011.

¹¹⁸Fletcher 2007; Whitley 1991; Haggis 2013a,b.

¹¹⁹Whitley 1991; Haggis 2013a.

¹²⁰Nevett 1999: 4-10; Westgate 2007a.

Chapter 3

Quantitative Reasoning for Archaeology

3.1 Why Numbers?

There is no reason to assume that a numerical or quantitative approach to archaeology should be better than a qualitative one. The advantage of quantitative methods lies in the necessity of declaring assumptions, the ability to easily handle large datasets in a consistent manner, the measures of uncertainty in observation as well as assertion, and the potential to reassess previous results independently of the original observer. Obviously these characteristics are not unique to quantitative and computational work. Yet although these are the best practices in all archaeological scholarship, they are necessary prerequisites for computational research. By choosing to use quantitative and computational tools to investigate social and economic organization in Archaic Crete, I am embedding my work in a standard of logical rigor. The burden rests on myself, however, to demonstrate that these methods are valid, in that they do what I say they do, and are consistent, so that other methods of inquiry could also have arrived at similar conclusions.

The quantitative analysis of archaeological data must embed the principles of inference into a numerical framework. This requires some recognition of the principles of inference, which have been helped along by many of the voices in the post-processual movement. As Schiffer discussed in his theory of behavior and communication, archaeological material forms the substance of infer-

ences, which are internal to the receiver in a tripartite semiotic system of communication.¹ Olivier similarly considers artifacts to be material traces that are used to justify modern preconceptions as well as theories of the past, which is fundamentally impossible to reconstruct.² Inference is not just a tool which archaeologists use to understand material, but is a process which takes external evidence (the material) and internal beliefs (theories and preconceptions) to build a mutually coherent system of information and knowledge.³

A quantitative version of inference must encode both data and beliefs. A treatment of beliefs is by far the harder of the two problems: beliefs are thought to be subjective, complex, and emotional, while numbers are thought to be absolute, simple, and rational. Yet beliefs are often propositions about the state of the world, making them logical in nature; further, they are held with differing degrees of certainty, which can be approximated by mapping certainty to the real number line, so that larger numbers indicate greater certainty; and finally, they are ideally consistent, so that as one belief grows stronger its antithesis grows weaker. Given these limits, Jaynes demonstrated that there is a unique numerical system that would encode beliefs, namely probability.⁴ Further, this uniquely defines and constrains the three axioms of probability theory, which define the properties of antithetical events, joint events, and the union of multiple events.⁵

To use probabilities as representations of beliefs, a greater probability is attributed to events that are considered more likely, while certain and impossible events are given probabilities of 1 and 0, respectively. The notation for the probability of an event A is $P(A)$; similarly, the probability of an event A and B occurring is $P(A, B)$. These are the probabilities of assertions that A or A and B are true, but do not reflect on a prior state of knowledge. The probability of an event A given that an event B has been observed is $P(A|B)$, with the previously observed event always on the right of the pipe.

The basic definitions of probability theory do not provide a means to incorporate data, however.

¹Schiffer 2002: 7-9, 30, 51-2.

²Olivier 2011.

³A statistician reading this may note the symmetry between this and the EM algorithm.

⁴Jaynes 1974: ch. 3.

⁵Jaynes 1974: 41.

Presently this framework includes only the tools to state a proposition and assess the plausibility of that proposition given other information. In order to take data into account, some clever algebra must be used, namely Bayes' Theorem.

$$P(A|B)P(B) = P(B|A)P(A) = P(B,A) \quad (3.1)$$

Equation 3.1 uses the axioms of probability to decompose the joint probability of two events into their produce of the marginal and conditional probabilities. More broadly, events can include observing data and parameters in quantitative models being correct. By replacing A with some observed data, D, and B with some model, M, Bayes' Theorem yields:

$$\frac{P(D|M) * P(M)}{P(D)} = P(M|D) \quad (3.2)$$

Equation 3.2 quantifies how to update beliefs describing the parameters of models as well as models themselves. From a generative stochastic model that assigns probabilities, or degrees of plausibility, to different observable data, the probability of the model itself can be assessed. This symmetry underlies most of modern statistics, as it allows models to be compared, the parameters of those models to be assessed as likely or unlikely, and ultimately theories to be built and contrasted. This all emerges from the constraints of logic on a numerical system and embodies logical process in inference. It enables beliefs to be proposed and updated given data; it can even enable data to be reinterpreted as theories change by alternating between updating the model and the data.

Bayesian probability solves many of the problems that post-processual archaeology has posed to processual archaeology concerning the theory-laden nature of data and the need to recognize subjectivity. Founded on the theoretical support from existing archaeological and statistical scholarship, I use Bayesian probability as a rigorous, quantitative logical system consistent with broader notions of common sense as well as specifics of archaeological inference.

3.2 Spatial analysis

While individual objects are often characterized by specific functions, assemblages in spaces are the units of activity analysis. There are two orthogonal perspectives on how to treat spatial variation in these activities. The first is to consider the activities that took place in a space. This is the more intuitive of the two options, perhaps because it is the easiest to visualize. It is in line with that view of the past that thinks of antiquity as a mental diorama waiting to be uncovered; it also fits the catalog-based approach to site publication, which considers spaces the subsections of larger compositional units. This is the framework that space syntax and house typologies use, and provides a higher-order descriptive framework that takes an equality of room types for granted.

A second view, one used less often explicitly and rarely quantitatively, is to examine a single activity across a building. Rather than attempting to define a space by a function or set of activities, the distribution of artifacts or features across a building can be linked to functions and built up to create a multi-layered image of past activity. Unlike the first approach, it does not establish categories or typologies, which makes relational approaches such as space syntax impossible.⁶ Unlike the first approach, each function is not majorly affected by the addition of new data. Consider for the former how the availability of a new type of evidence, such as the ceramics at Azoria, would add new functions to each room and require a reclassification of spaces, which needless to say would alter higher-order analyses. Compare that with the presence of new information on existing or new functions in the distributional approach: either a new function is considered and compared with the existing data, or an existing distribution is updated with new data in a predictable manner. Although this example may seem artificial, the potential for reanalysis and new forms of data is always present, and methods must take this into consideration.

In order to implement this second approach in a Bayesian framework, I introduce the categorical probability distribution. A probability distribution reflects the frequency or likelihood of events, which at some level of description are mutually exclusive. A distribution over a discrete number of events effectively describes the probability of observing any one event, or category, once. In the

⁶This does not include the gamma analysis and other movement or centrality measures, however..

spatial activity case, each category represents a room, while the probability represents the belief of how much of that activity took place in that room, or how probable a single observation in that room would be.

The naive approach to using a categorical distribution to model activity would be to consider a linear relationship between the number of objects (e.g. spindle whorls) and the amount of activity in that room. This ignores the architectural limits on activities considered above, and provides no means to incorporate other sources of information or prior beliefs about behavior.

The Bayesian approach requires prior beliefs to be defined and updated in the form of a distribution of parameters; for the categorical case, prior beliefs are quantified as a Dirichlet distribution. The Dirichlet distribution is the probability distribution over categorical probability distributions, and has concentration parameters α_i for each category which determine the probability of that category (reflected by the ratio between α_i and $\sum_i \alpha_i$) as well as the certainty of that category (determined by the magnitude of α_i). Technically, the probability of observing any categorical distribution with probabilities (x_1, \dots, x_k) is given in equation 3.3.

$$Dir(\alpha_1, \dots, \alpha_k) \sim \frac{\Gamma(\sum_{i=1}^k \alpha_i)}{\prod_{i=1}^k \Gamma \alpha_i} \prod_{i=1}^k x_i^{\alpha_i - 1} \quad (3.3)$$

The initial parameters of the Dirichlet distribution are defined based on prior beliefs. If no prior information exists, so that each category is thought equally probable before the data are considered, then the logical choice would be a uniform probability distribution over all possible distributions, which is equivalent to defining $\alpha_i = 1$ for all categories. Architectural constraints or other evidence can inform this distribution by defining some parameters to be zero (so that the probability assigned to that space will remain zero) or increasing others (in order to reflect installations that suggest any particular activity).

The Dirichlet distribution is updated as more information is considered. The parameters are updated according to Bayes' rule, which in this case means that for every observed artifact the parameter for that room should be increased by one. This follows common sense for most rooms: if an activity could take place in that room, and an object in that room could have been used for that

activity, the plausibility of that room being used for that activity should increase. When artifacts are outside of use contexts, however, this framework does not provide a single solution. Instead, I rely upon the principle of maximum entropy, or indifference, which was also used above when a uniform distribution was used to encode the absence of knowledge about the probability of each category. Here again, without knowing the room in which an object may have been used, I choose to assign it equally to all possible rooms, so that each parameter $\alpha_i > 0$ is increased by an equal fraction. When architecture and artifacts agree, this results in more probability being assigned to that space; when there is a difference between architecture and artifacts, adding an equal amount to every parameter increases the uniformity of the distribution, which in turn reflects the uncertainty of activity contexts in the building.⁷

Once the Dirichlet distribution reflects the information from all sources of evidence being considered, the Bayesian estimate of parameters is simply the expected value of the distribution. This is expressed in equation 3.4.

$$E(x_i) = \frac{\alpha_i}{\sum_{i=1}^k \alpha_i} \quad (3.4)$$

As noted above, this states that the expected probability of any single category is simply the ratio between that category's parameters and the sum of all parameters. Similarly, the variance can be computed given the parameters of the distribution, as seen in equation 3.5.

$$Var(x_i) = \frac{\alpha_i(\sum_{i=1}^k \alpha_i - \alpha_i)}{(\sum_{i=1}^k \alpha_i)^2(1 + \sum_{i=1}^k \alpha_i)} \quad (3.5)$$

These two results are intuitive, as for a large number of observations it approaches the observed data, which is to say that prior uncertainty becomes less important with more observations. By accounting for prior uncertainty, as well as uncertainty from artifacts in non-use contexts, this approach is more subtle in dealing with partial and small data sets, naturally an issue for archaeology. Further, unlike a naive approach of simple counting, this enables the variance for each

⁷This conflation between uncertainty and uniformity has already been remarked on archaeologically, see Olivier 2011.

estimate to be calculated and for uncertainty to be better characterized between contexts, enabling more rigorous comparisons between different buildings.

Part II

Material

Chapter 4

Azoria

Azoria in East Crete overlooks the Kavousi plain near the sites of Kastro and Vronta. The site covers all but the steepest slopes of a double acropolis for a total area of 8 ha (fig. 4.1). The longest period of occupation began in LMIIIC, when a sizable settlement was built on the western slope of the south acropolis. Although few complete buildings have been recovered, the benched temple and agglomerated architecture are consistent with the evidence from other nearby LMIIIC settlements, such as Vronta and Chalasmenos.¹ Into the early first millennium BCE, an EIA settlement expanded down the west slope, and a large temple complex integrated a Protogeometric tomb and a dining complex with the more traditional form of a hearth temple.

Around 630 BCE, the site was transformed by its inhabitants. Described as a distinct stratigraphic level indicative of a phase transition, most earlier buildings on the site were buried through a combination of leveling, intentional fill, and deliberate collapse of walls.² Above this stratum a new settlement was constructed following a deliberate architectural plan. Long, continuous spine walls linked a mixture of civic and domestic buildings into terraces. Truly monumental construction first appeared on the site, and evidence of complex social and political systems include three separate civic buildings: the Communal Dining Building, the Monumental Civic Building, and the Cult Building. Each had significant storage and food processing facilities (the Communal Dining

¹Haggis et al. 2007a; Haggis 2014a.

²Haggis 2014a,b.

Service Building and the Service Building, respectively) and themselves contained feasting and cult activities.³ The Communal Dining Building contained a ground altar and separated dining rooms for small-group feasts, while the Monumental Civic Building has a large hall with benches along the walls for undifferentiated group feasting.

Houses were also integrated into the architectural plan of the settlement. Most houses are large, roughly axial, integrated into the spine walls that commonly support public and domestic structures on the terraces.⁴ The plans of houses appear to have been minimally modified over the life of the settlement, in sharp contrast to earlier patterns of agglomeration at Kavousi Vronda and Kastro.⁵

In the early 5th century BCE the settlement was abandoned and destroyed by fire, which has preserved sizable late Archaic assemblages from all types of buildings. I now examine the economic and social organization of the Archaic settlement given the available data.

4.1 Material Evidence and Data

The site has been excavated since 2002 by UNC and Iowa State under the auspices of the American School of Classical Studies at Athens. Although no final publication exists, comprehensive annual reports combined with the project's databases present a coherent body of material for analysis, particularly for the Archaic period. The data are not yet available consistently across all seven years of the project because of the ongoing nature of the excavation.

- Ceramics are not presently available in detail for any year, pending the publication of the first campaign's catalog.
- Ground stone tools have an extensive catalog for the first five years of excavation, but are not available for the most recent campaign.

³Haggis et al. 2011b: 63-5.

⁴Haggis et al. 2011a: 477-8.

⁵Haggis et al. 2011a: 477; Haggis 2014a: 130-1; Glowacki 2000, 2007; Mook 1998, 2011.

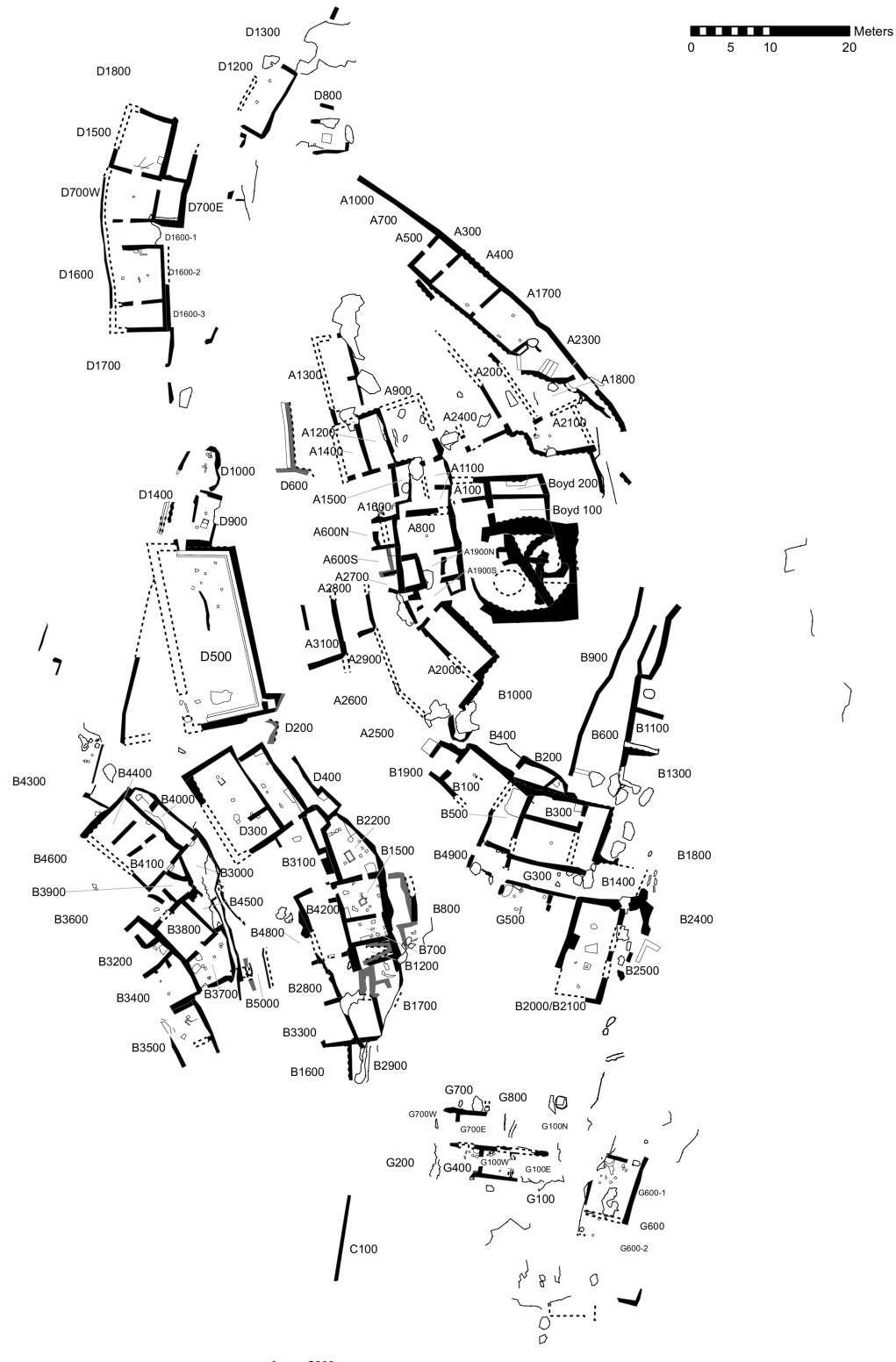


Figure 4.1: Site plan of Azoria.

Rooms are labeled following present terminology. Generated from data collected by R. Fitzsimons, G. Damaskinakis, and the author.

- Small finds are compiled for all seven years, although the earlier campaign has had more rounds of revision and thus the data are of higher quality. Further, the database lacks many critical details for the metal finds of the last two years (2013 and 2014) which hinders investigation of these particular objects.
- A plan is available for the most recent years of excavation, but detailed analysis by the architect is only available for the first five years.⁶
- The field notebooks and reports are available for all seven years, in addition to a heavily annotated deposit list for the first five years that classifies stratigraphy.

The data do not exist in a standard format and require significant preprocessing for use. The Carolina Digital Repository (CDR) contains an annotated list of loci along with excavators' notebooks, which I updated to include the 2013 and 2014 field materials.⁷ The original deposit list was updated on the basis of preliminary observations and interpretations, and will require significant future updates. For the time being, it provides essential information on the chronology and nature of strata across the site, and allows the selection of pails that are from habitation and roofing material of Archaic buildings.⁸ I annotated these with more specific descriptions that included information on which particular area each pail was associated with if a single trench number was used to excavate multiple rooms, or multiple trench numbers to excavate a single space. These assignments come from annotations in the pail list as well as the excavators' notebooks for those trenches.

Objects were extracted from the two databases of small finds and the database of stone tools from the first campaign. I selected only objects from Archaic habitation and roofing debris and

⁶Fitzsimons 2014.

⁷The original data are present at <https://cdr.lib.unc.edu/>.

⁸Pails are the smallest functional subunit of the Azoria catalog system. ATLP (area, trench, locus, pail) codes define a specific pottery bag with a three dimensional spatial extent and other information such as artifacts, soil samples, and zooarchaeological remains. These are the core of the Azoria database, although most descriptions here will only use area and trench (e.g. B2200, D1600) with room-level description where applicable (e.g. D1600-2)..

analyzed them by object type (spindle whorl, loomweight, etc.) before being recombined with data of other varieties. Objects were sorted by room and by building depending upon the relevant scale of analysis. Buildings were identified and labeled on the basis of prior publications and current project terminology.

4.1.1 Preservation

A preliminary issue for the site is the exact nature of the preservation of finds. The site has been discussed as a rapid abandonment in most publications, which implies that only valuable objects were taken or moved, while bulkier or less valuable items were left in their previous locations. Not all of the evidence, however, is exactly in line with this view. The storeroom D1600-3, for example, contained at least eight pithoi (as expected given the number of plakas in the room) but also numerous other vessels, while the adjacent kitchen D1600-2 had numerous pot stands with few corresponding pots. Abandonment differentially affected rooms within individual buildings, and locations of objects may not be as clear as a “secure context” first implies.⁹ Issues of taphonomy apply even in burned contexts, and the representativeness of the objects excavated has not been readily discussed.

The problem is twofold, in that preservation involves the type and the location of objects. One means of considering the first aspect of this problem is to look at the types of material that are preserved across different contexts of the site. I examine these by applying Guttman scaling to the presence of different materials by building. Guttman originally proposed this method of data visualization for qualitative analysis of presence-absence data on a societal level, but fundamentally the approach allows co-occurrences and attributes of a dataset to be visually evaluated across multiple types of data.¹⁰

⁹LaMotta and Schiffer 1999.

¹⁰Carneiro 1962.

	Other	Silver	Glass	Bone	Shell	Lead	Iron	Stone	Bronze	Terracotta
North Building										*
East Corridor House								*	*	*
Communal Dining Building					*		*		*	*
Southwest House							*	*	*	*
South Building 2	*						*	*	*	*
B3700-B3900 Building				*			*	*	*	*
North Acropolis Building				*			*	*	*	*
Communal Dining Service Building						*	*	*	*	*
West Corridor House						*	*	*	*	*
Monumental Civic Building			*			*	*	*	*	*
Northwest Building			*			*	*	*	*	*
Service Building				*		*	*	*	*	*
Northeast Building		*			*	*	*	*	*	*

Table 4.1: Guttman scaling of preserved material by building.

I divided artifacts into eleven material categories across the fifteen buildings for which Archaic material has been found. Following Carneiro's guidelines, I sorted attributes and buildings according to increasing frequency, allowing both buildings and types of material to be compared simultaneously. The result is displayed in table 4.1.

Terracotta, stone, bronze, and iron objects are the most commonly recovered objects across these buildings. Silver, shell, glass, and slag all appear much less frequently through a combination of lower overall occurrence, greater under-representation because of abandonment processes, and differences in the recoverability of material. The less frequent types of material do not systematically vary among contexts, which suggests that their presence or absence more likely results from their rarity rather than taphonomic issues. The preservation of bronze, stone, and lead objects varies systematically and reflects the overall preservation of a building.

This is useful for understanding how contexts have fared. The Northeast building, Northwest building, Monumental Civic Building, and Service bBuilding all contain most types of materials, even those less well represented in other contexts. The Communal Dining Building and its service building, as well as the other houses, display fewer types of objects and may contain less representative objects by comparison with the first set. I note that this analysis ignores differential abandonment processes among contexts, which affects the type of objects found but not necessarily the presence or absence of materials. In the interest of understanding taphonomy, I have chosen this weaker claim to elucidate preservation.

A stronger claim about the location and movement of objects can be made by considering the types of objects found in different rooms. Architecture limits the lighting, ventilation, and space available for different activities, and can be used to infer whether objects could have been used in the same spaces as their findspots.¹¹ Based on the adjacency of other buildings, the evidence for roofing materials, and the evidence for built hearths, I assigned each room a potential access to light: no light, indirect light, or direct light (see tab. 4.2). I then defined limitations on the spaces in which three common activities occurred across the site, namely spinning, weaving, and food

¹¹See 2.2; Mann 2015.

processing. Spinning is highly mobile, requires little attention, and can occur in all but the darkest spaces; weaving, in contrast, is best done in indirect light to avoid fading dyes, and is ideal by a door leading to an open courtyard or in windowed rooms.¹² Food processing requires light and space, while food preparation requires sources of heat, either hearths or ovens.¹³

For each building, I counted the number of loom weights, spindle whorls, and stone tools that could not have been used in the rooms they were found in because of architectural constraints. I then compared this to the total number of each type of object found in each building to measure the percentage of possibly displaced objects by context, as well as the total disparity between findspots and probable use contexts. I emphasize again that this displacement reflects taphonomy, abandonment conditions, and storage, all without discrimination; it is simply an indicator of whether deposits can be ruled out as reflecting use contexts.

As seen in table 4.3, most buildings are slightly disturbed. The East Corridor House has had all of the objects displaced according to this measure. The Service Building and North Acropolis building appear to have had loom weights in kitchens, where they may have been stored, used when the hearth was not active, or used for other purposes. Overall, buildings at Azoria contain a large number of objects in possible use contexts, although as is evident this varies even within buildings among different types of material. Given the material-based examination of taphonomy above, metals are likely only as disturbed as any of the finds considered here, although the large quantity of highly fragmentary material makes it difficult to characterize the nature or use of most metal objects.

The distribution of artifacts supports the findspots of many objects to be probable use contexts. Spatial analysis within rooms is not generally possible, but comparisons between rooms and buildings is a valid technique to apply at Azoria, as the analyses of material and spatial biases suggest. I begin by treating assemblages on the level of buildings, as this minimizes biases from disturbed from use contexts, and then proceed to examine the internal organization of buildings.

¹²Barber 1995: 113-4.

¹³Given the absence of accessible, systematic ceramic records for the site it is not presently possible to investigate food preparation or consumption in most contexts.

	Direct Light	Indirect Light	No Light
Count	16	42	9

Table 4.2: Number of rooms categorized into each category of access to light.

Building	Whorls	Weights	Stone Tools	Magnitude
B3700-B3900 Building	0.25	0.12	0.19	0.19
Communal Dining Building	-	0	-	-
Communal Dining Service Building	0.43	0.57	0.39	0.48
D800	-	-	-	-
East Corridor House	1	1	1	1
South Building 2	-	-	-	-
Monumental Civic Building	0	0.5	0	0.29
North Acropolis Building	0	1	0	0.59
North Building	-	-	-	-
Northeast Building	0	0	0	0
Northwest Building	0.5	0.16	0.75	0.54
Service Building	0	1	0.045	0.59
Southwest House	0	0	0	0
West Corridor House	0	-	0	-

Table 4.3: Percentage displacement of objects based on architectural limits.

Displacement was calculated for three broadly distributed and recorded types of material, namely spindle whorls, loom weights, and stone tools. The magnitude of displacement is the renormalized length of the vector, which varies from 0 (everything was in a possible use context) to 1 (nothing was in a possible use context) and allows buildings to be ordered by their state of displacement. Empty cells indicate no objects of that type were found in that building.

4.2 Textile Production at Azoria

The physical remains of textile production are often ceramic implements, which are well preserved in many contexts at Azoria. Spindle whorls and loomweights enable reconstructions of what types of thread and fabric were produced, while needles, awls, and bobbins suggest other embellishments and techniques. A small piece of plant (likely flax) thread was found attached to a helmet fragment.¹⁴ No other evidence of textiles themselves has been recovered at Azoria.

4.2.1 Spinning

47 spindle whorls occur in habitation or floor deposits dated to the Archaic period at Azoria. The variation in size indicates significant heterogeneity in the threads spun, as the thickness of fiber spun is proportional to the weight of the spindle whorl.¹⁵ Although not all of the whorls are complete, their circular shape and radial fracture patterns make it easy to estimate the percentage missing and enable reconstructions of the complete weight. I use these reconstructed data for the remainder of my analysis.

The mass distribution is roughly bimodal, with one mode below 30 g and another above 35 g. The CTR does not identify a maximum limit on the weight of a spindle whorl, but their research implies that spindle whorls over 40 g would not have produced thread suitable for weaving on most looms. 13 of the securely dated spindle whorls are more than 45 g, and were either used for plying threads into thicker ropes or are weights misidentified as whorls.¹⁶ Four whorls came from contexts with unclear spatial boundaries and could not be definitively associated with the Archaic phase.

The 30 remaining whorls are small and globular to toroidal in shape. The CTR classified whorls into four mass divisions centered around 10, 20, 30, and 40 g. Based on these classes, the lightest whorls (less than 15g) account for nearly half of all whorls, reflecting the increased labor input

¹⁴Möller-Wiering 2006.

¹⁵See above, 1.1.1.

¹⁶Burke 2010: 115.

Building	(0,15]	(15,25]	(25,35]	(35,45]
B3700-B3900 Building	0	1	1	0
Communal Dining Service Building	1	2	1	0
East Corridor House	0	1	0	0
North Acropolis Building	5	0	1	0
Northeast Building	0	0	1	1
Northwest Building	0	0	0	1
Service Building	6	0	1	1
Southwest House	2	1	0	1
West Corridor House	0	1	1	0

Table 4.4: Spindle whorls by weight and building.

required to generate sufficient quantities of thin thread for fine textiles (table 4.4). This pattern is also evident at Iron Age Gordion and Tell Mardikh-Ebla, both of which have published significant deposits of spindle whorls with a similar interpretation.¹⁷

The combinations of weights indicate the range of threads spun across domestic contexts. A general difference between the buildings with lighter whorls (less than 15g) and the heavier whorls (greater than this) emerges, as the North Acropolis building has many of the lighter whorls, while the B3700-3900 building, the West Corridor House, the Northeast Building, and the Northwest building all contain more of the heavier whorls. Although not a strong enough difference to suggest specialization, there may be some interaction among households involving goods and labor, as spinning may be social and mobile.¹⁸ Households may also differ in their needs for thread.

Many whorls were found in non-domestic contexts. The Service Building primarily contained small whorls used for spinning very fine threads, similar to the North Acropolis building. The Communal Dining Service Building contained slightly heavier whorls, and is most similar to the West corridor house and the B3700-B3900 building. Although sample sizes are small, the two service buildings are more similar to different houses than to each other. Given the general similarity among the different houses, these distinctions may reflect sampling rather than distinctions in houses, but definitely suggest a difference between the two service buildings. By contrast, the

¹⁷Burke 2008; Peyronel 2008; Burke 2010.

¹⁸See sec. 1.1.1.

Monumental Civic Building and the Communal Dining Building lacked any whorls.

Spinning was not a spatially specified activity. The differences between houses with large numbers of small whorls and smaller numbers of large whorls suggests that every house may not have necessarily produced all of its own thread. These differences among the buildings probably reflect the interactions and labor sharing expected among the parallel institutions of the dispersed households. The larger deposits of smaller whorls in the North Acropolis Building and the Service Building imply a larger expected group of spinners and more intensive labor than the other buildings, which fit better with the casual, social model of weaving within a smaller group.

4.2.2 Weaving

Loomweights appear across civic and domestic contexts, although they cluster especially in the Northwest building and the B3700-B3900 house (table 4.5). Within Archaic deposits at Azoria, loomweights are typically 2-3cm thick and weigh 35 to 70 g.¹⁹ The total variation in weight is small compared with the extreme ranges present in the region: weights from EIA Azoria and the Kastro can weigh up to 2 kg with bases over 13 cm thick.²⁰ Archaic Azoria primarily produced fine dense fabrics, judging from comparison with the CTR's experiments.²¹ The actual distribution of weights and thicknesses are not consistent with the CTR's exact limits on functional properties, likely because their experiments attempted to reconstruct Bronze Age tabby weaves rather than later twill weaves. Twill requires more heddles to shift the warp thread, and the added support probably removes some of the difficulty with shedding warps. In relative terms, at least, the fabrics produced with these loomweights would have used very fine threads.

Weight and thickness are loosely correlated among loomweights at Azoria (fig. 4.2 mid.). Mass varies more than thickness, although summarizing the data by mass only captures a small portion of the variability of the data (42%). This is more meaningful, however, than variation according to thickness, as the masses suggest fabrics woven effectively varied from denser and finer fabrics

¹⁹Eaby 2013.

²⁰Eaby 2013; Mook 1993: 282-9.

²¹Mårtensson et al. 2009: 390.

Building	Count	Weight (med.)	Thickness (med.)
B3700-B3900 Building	17	59	3.5
Communal Dining Building	8	61	3.4
Communal Dining Service Building	7	50	3.3
East Corridor House	1	40	3.0
Monumental Civic Building	2	54	3.4
North Acropolis Building	3	70	3.7
Northeast Building	1	50	3.4
Northwest Building	19	41	2.7
Service Building	6	58	3.5
Southwest House	6	53	3.3

Table 4.5: Summary of loom weights by building.

to more open and coarse fabrics. The Northwest Building marks the extreme of fine fabrics, and had a cache of loomweights that were likely part of a single loom (fig. 4.2 bot.). In the middle of the spectrum the Northeast, Southwest, and Communal Dining Service buildings contained loom weights for producing coarser textiles. On the coarsest side of this spectrum, the North Acropolis building, the Communal Dining Building, B3700-B3900 building, and the Service Building contained weights for producing coarser and more open textiles, although still comparatively fine. Few of these buildings contain sufficient weights for a full loom, and these traces may reflect the portability of looms. The B3700-3900 Building and the Northwest Building may have contained small looms at the time of their destruction.

Weaving is attested across the site, although sufficient evidence for looms to be definitely located is present only in two buildings. Weaving cannot be carried out in parallel on the same scale as spinning, but there is nevertheless the possibility that looms in a few houses may have served a larger dispersed household or group of households. Weaving, like spinning, does not occur at a large enough scale or in sufficiently few contexts to be a specialized activity.

4.2.3 Textiles

Spinning and weaving are not specialized, but nevertheless imply significant cooperative economic coordination across the site. The median masses of spindle whorls and loom weights are negatively

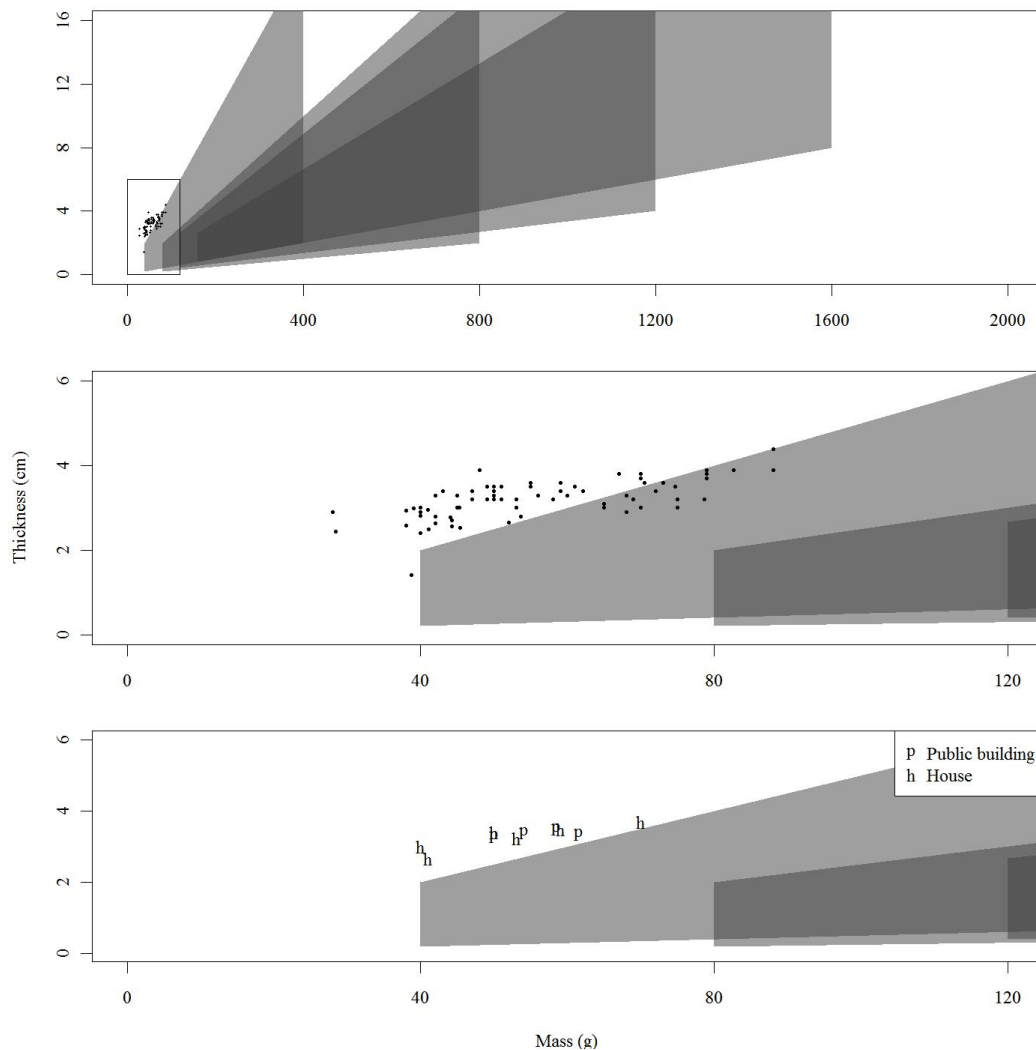


Figure 4.2: Mass and thickness of loom weights at Azoria.

Top: The Azoria Archaic loom weights plotted against the CTR's limits of possibility for the creation of different textiles. Most of the Azoria loom weights do not fall within the boundaries of possibility, which may result from the creation of twill rather than tabby weaves (see text.) The box marks the region of interest for the middle and bottom panes.

Middle: The Azoria Archaic loom weights at a larger scale, so that the linear trend is more visible.

Bottom: Median weight and thickness by building. Buildings are marked as either public or houses; consult table 4.5 for individual buildings.

correlated with each other when considered by building ($\rho = -.75$): houses producing coarse fabrics are spinning lighter threads than they use. The negative trend is significant ($\alpha = .05$) after bootstrapping the spindle whorl and loomweight masses by building (N=1000) when the problem is approached as a one-sided comparison, which tests the number of potential data sets for which the correlation is negative.²² Most houses have the equipment to weave fine fabrics and spin coarse threads; in contrast, the North Acropolis Building and Service Building spin large quantities of fine thread and weave coarse fabrics. Spinning and weaving are not self sufficient within buildings, but rely upon interactions and collaborations with the distributed houses of the household as well as other households and groups. This contrasts with Tell Mardikh-Ebla and Gordion, where the masses of whorls and weights corresponded and enabled self sufficient production within the buildings analyzed.²³

Whether formalized as labor sharing or goods exchange, time spent on production is unevenly divided among the different buildings, with the most time consuming activities (the spinning of fine thread) associated with the production of coarser textiles. The Service Building is an extreme case of this, as in addition to small spindle whorls the building also contained a set of bone bobbins for embroidery or braiding.²⁴ These asymmetries may reflect divisions in labor based on context, status, gender, or dependency, a difficulty addressed below once more forms of material have been examined (sec. 4.5.1).

4.3 Food Production at Azoria

The extensive recovery of floral and faunal remains at Azoria has enabled the inference of foodways across the site. I briefly summarize the results of these two forms of evidence, and then

²²The test fails when considered as a two sided parameter estimation test, which would attempt to reject that 0 is a viable parameter for the correlation. The data, namely the types of loom weights and spindle whorls found across the different buildings, support a negative correlation; correlation, however, is not a good measure to use on the data. Using a correlation coefficient assumes a linear relationship between two variables, and a linear model accounts for little more than half of the variance ($\rho^2 = .56$) with minimal explanatory power. Effectively, the difference in significance between the two tests reflects this model-dependent ineffectiveness..

²³Burke 2008; Peyronel 2008; Burke 2010.

²⁴Haggis et al. 2007b: 288.

proceed to discuss other evidence for food processing and preparation using the small finds and ground stone tools.

Paleobotanical remains from across the site support a diet of pulses and grains supplemented by other vegetables and fruits. Houses and public buildings largely accomplished final stage processing of foods, such as grinding cleaned cereals and pulses, as well as cooking with wine and oil.²⁵ Houses received food from other urban and rural houses as part of a distributed household, and in turn gave some of these foods to the storerooms of the public buildings.

Meat was processed and distributed by two different means. Most bones from domestic contexts were preprocessed, with the Northwest building providing some of the only evidence for domestic butchery.²⁶ Civic buildings engaged in more butchery, especially using cleavers. The Service Building contained a deposit of mandibles (B1700) as well as an extensive dump of debris from butchery and cooking (B3100), while the Communal Dining Building and the Monumental Civic Building had cuts of meat divided by cleaver and then either potsized (the former building) or roasted as whole limbs (the latter).²⁷ Although the importance of cleaver and non-cleaver butchery is still being assessed, the distinctions between the potsized pieces of meat in the Communal Dining Building and the articulated leg segments in the Monumental Civic building indicate different manners of feasting likely imbued with social and ideological meanings, echoing distinctions in the ceramic record.²⁸ The types and manners of foods processed and prepared are thus distinguished primarily in the civic buildings, while most of the houses are fairly similar.

4.3.1 Food processing: stone tools

Ground stone tools are the most common food processing implements. Tsoraki has compiled a catalog for the first five years, which includes physical, geological, and morphological/use-mark data. A complete publication of the catalog and the subsequent years of data is in progress, which

²⁵Haggis 2014a: 136; Haggis and Mook 2011: 370; Haggis 2014b: 27.

²⁶Dibble 2013.

²⁷Haggis et al. 2011b: 44, 62; Dibble 2013.

²⁸Haggis et al. 2011b: 9, 14, 24-6.

will include more detailed information as well as chemical and micromorphological laboratory analyses. Here I focus on the modes of food processing implied by the ground stone tools to supplement the paleobotanical and zooarchaeological information.

Tsoraki identified wear marks on each stone tool indicative of different physical actions, such as grinding, perforation, or polishing. Querns and hand stones are common, and generally associated with the creation of pulse and grain flours of varying fineness as well as cracking seeds and pulses for easier cooking. I focused on three relevant functional categories, those of abrasive, grinding, and percussive tools. Grinding and abrasion are both rotary or lateral motions that reduce particle size, but grinding describes larger particles being reduced with more force while abrading implies less force to break down smaller particles. The difference reflects the type of foods being reduced (pulses vs. cereals) as well as the fineness of the product. Percussive marks indicate the vertical application of force to crack, fracture, or split foods.

Grinding and percussive tools were the most common across the site, while abrasive tools were somewhat less common (table 4.6). Most buildings contained less than twenty tools associated with food processing, with the notable exception of the Service Building, which contained over fifty. The Communal Dining Service Building contained only eleven, similar to most of the houses. The quantity does not correlate with the indices of preservation discussed above, which suggests that most of this variation reflects different scales of food production between the Service Building and other contexts.

The frequency of each functional type varies among buildings (fig. 4.3). The ratio, however, remains relatively constant across the different buildings, with grinding always the most common tool type. The Service Building is the sole outlier. Although the ratio of grinding and percussive tools is similar to the houses, it has significantly fewer abrading tools. Further, the kitchens in the Service Building account for half of all percussive and grinding tools. The relationship between scale and type of food processing is difficult to assess in the absence of comparative buildings with published ground stone tool assemblages, but increased productive scale requires qualitative changes in the mode of processing and the organization of labor, and differential scaling effects

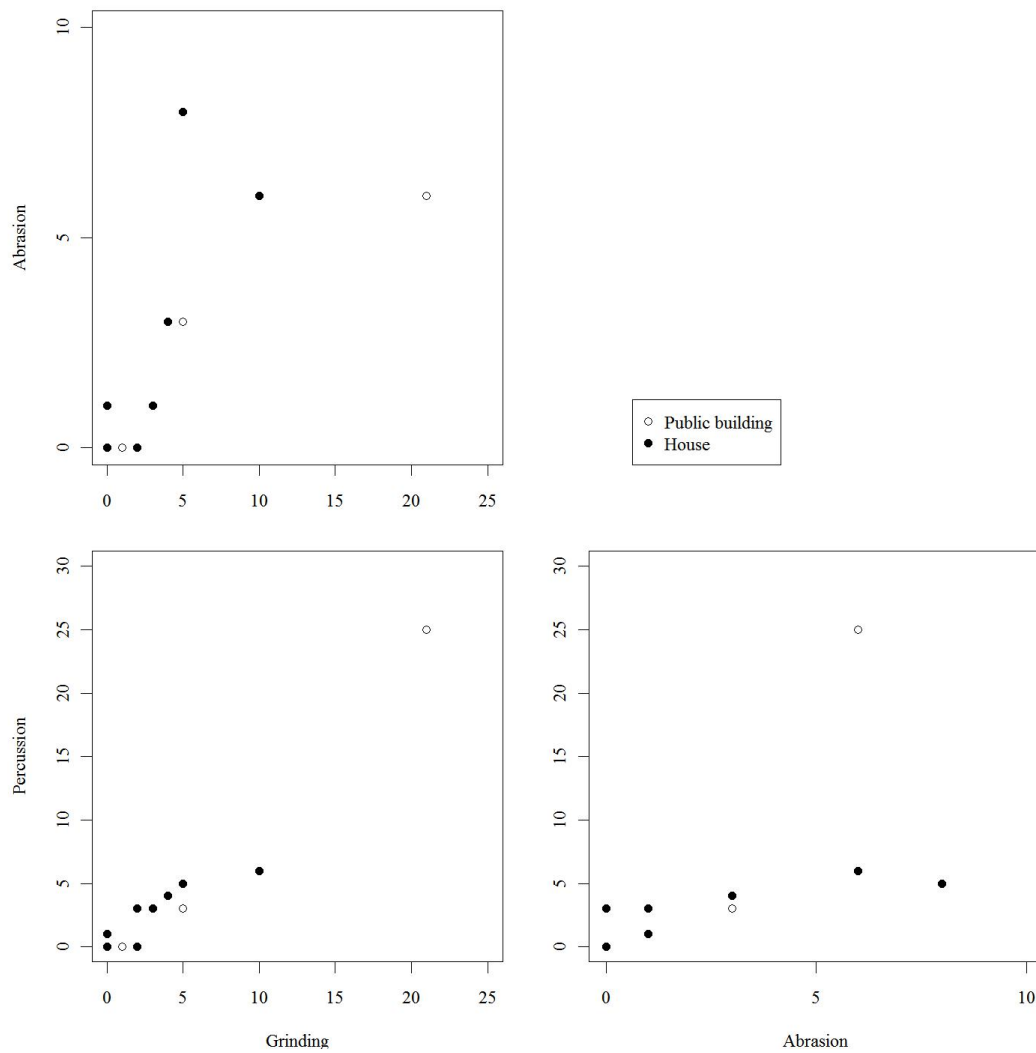


Figure 4.3: Counts of ground stone tools plotted by building and function.

Building	Abrading	Grinding	Percussive	Multi-use	Total
B3700-B3900 Building	6	10	6	4	22
Communal Dining Service Building	3	5	3	0	11
East Corridor House	0	2	0	0	2
Monumental Civic Building	0	1	0	1	1
North Acropolis Building	8	5	5	2	18
Northeast Building	3	4	4	3	11
Northwest Building	1	0	1	0	2
Service Building	6	21	25	12	52
Southwest House	1	3	3	2	7
West Corridor House	0	2	3	2	5

Table 4.6: Ground stone tool counts by building.

across types of labor could result in this altered ratio of tools. The different proportions of tools may also suggest a different set of products, but without further access to the paleobotanical and zooarchaeological data for the public buildings this claim is not assessable.

Alternatively, the different ratios of tools could indicate another means of achieving similar ends, a different *habitus*, that informs how grains and pulses were processed in the Service Building compared with other contexts. This latter claim is only defensible for labor organization and not the actual use of tools, however. Multi-use tools comprise around 20% of the stone tool assemblage across all buildings, which suggests that the actual mechanical use of tools is the same in all cases. Instead, the activities of food processing are accomplished through a different *chaîne opératoire* in the Service Building than in the Communal Dining Service Building.

4.3.2 Food preparation: hearths, knives, and oboloi

The two buildings are also distinguished by their methods of food preparation. Hearths and cooking features are associated with ground stone tools along with extensive assemblages of cooking pots and equipment such as strainers in kitchens across the site, but without more detail on use marks and the types of vessels in each building it is difficult to assess significant differences in food preparation. Two types of metal finds, however, inform distinctions between the Communal Dining Service Building and the Service Building as well as the other kitchens.

Building	Knife frag.	Obolos frag.
B3700-B3900 Building	0	0
Communal Dining Building	0	0
Communal Dining Service Building	6	0
D1200-D1300 Building	0	0
D800	0	0
East Corridor House	0	0
Monumental Civic Building	3	0
North Acropolis Building	0	0
Northeast Building	2	0
Northwest Building	1	0
Service Building	0	3
South Building 2	1	0
Southwest House	1	0
West Corridor House	1	0

Table 4.7: Knife and obolos counts by building.

Small knives are testified through hilt and blade fragments and appear in many buildings with kitchens, excepting the Service Building, the North Acropolis Building, and the B3700-3900 building (table 4.7). Fragmentary knives are most common in the Communal Dining Service Building, and suggest a different type of food preparation or prepared foods than in the Service Building. In particular, they fit descriptions of feasting debris from the Communal Dining building, especially cuts of meat reduced for individual portions.²⁹

The presence of three obolos (spit) fragments in the Service Building also suggest a different means of preparing meat compared with the Communal Dining Service Building. Spits for roasting meat complement the presence of whole leg joints and burned bones in the dining debris of the Monumental Civic Building.³⁰ The overall lack of oboloi in Archaic deposits makes comparison difficult, but they do corroborate the noted consumption differences between the two civic buildings.

²⁹Haggis et al. 2011b: 9, 14.

³⁰Haggis et al. 2011b: 26.

4.3.3 Culinary Choices

Status-related variation in the types of foods is not apparent with the present publications of paleobotanical and zooarchaeological data. Methods of preparation suggest two different modes of processing and cooking foods: those of the Service Building, and the rest of the site. Meat for the most part was butchered before being transported to kitchens for cooking; there, food preparation took place alongside the grinding of grains into fine flour and the processing of pulses and vegetables. In the Service Building, the more mechanically taxing tasks of grinding and percussive breaking are common at a large scale, while roasting whole joints is strongly attested by multiple forms of evidence. The Service Building is also marked by the olive press, which would have required extensive manual labor because of the crushing methods.³¹

Food at Azoria has largely been discussed in terms of mobilization of resources from the countryside and the social as well as ideological meanings imbued in the consumption of food. Production differences also convey information, however. Both the Service Building and the Communal Dining Service Building have the necessary equipment to fulfill the specific culinary needs of their dining venues, and the difference in scale and labor input required in the Service Building reflect in part the larger space of the Monumental Civic Building. They also reflect a different cuisine, as the two buildings treated similar foods in different manners. For earlier periods in Crete, culinary differences carried ideological, ethnic, and social messages, especially in their choice for different types of feasting.³² These trends possibly resurge in the Protogeometric period, although the continuation of ethnic affiliation is unclear.³³ These differences will be further interpreted once I complete my presentation of the spatial evidence.

³¹Haggis et al. 2011b: 46-61; Foxhall 2007b: 178-9, 216-7.

³²Borgna 1997.

³³Borgna 2004a.

4.4 Spatial Organization of Buildings

Greek houses and civic buildings are normally characterized by the organization of activities in space.³⁴ I have already demonstrated the diversity of material preserved at Azoria as well as the variation in preservation among the different buildings. This latter point is not a unique problem, but one that has not been suitably addressed in other analyses of Greek houses. I do not believe that a post-processual attempt to condemn theory and consider the house as an individual entity without anchors is sufficient, however.³⁵ Instead, I intend to account for differences in preservation systematically by quantitatively treating the process of archaeological inference.³⁶

Using the architectural limitations above, I determined the possibility of spinning, weaving, and processing food in each space at Azoria. Following the methods outlined above (sec. 3.2), I calculated the Dirichlet parameters for each building and activity using artifact counts of spindle whorls, loom weights, and ground stone tools. I used these parameters to calculate the probability as well as the variance of each activity in each room.

Spaces for Spinning Spinning is affected by few architectural constraints; the distribution of spinning within buildings reflects artifacts and uncertainty, with little negative knowledge.³⁷ In the Service Building, Communal Dining Service Building, and the B3700-3900 house, spinning is primarily concentrated in one room, although some probability remains distributed throughout the other possible spaces on account of the small number of whorls (see fig. 4.4). In the North-east Building, Northwest Building, South Building 2, and Southwest Building there is insufficient evidence to identify a single concentration of spinning in any set of spaces. Spatial distributions support spinning to be a highly portable and potentially social activity without strong specification by room in most cases. Combined with the types of spinning and the implied interactions as part of textile production, spinning appears to be a widely distributed activity with little surprising

³⁴Sec. 2.2, pg. 28.

³⁵Contra Souvatzi 2008, esp. 41-8.

³⁶See 3.1.

³⁷By this I refer to the observation of a true-negative, which provides significantly more information than probability in many situations.

variation.

Spaces for Weaving The requirement of indirect light reduces the number of spaces in which weaving can occur; even so, weaving is highly concentrated in many buildings. In the Northwest Building, the West Corridor House, the Communal Dining Service Building, and the B3700-3900 building a single room is the most probable location for all weaving (see fig. 4.5). In most other buildings, loom weights were too rare to meaningfully deviate from the uniform prior assumed (e.g. the Service Building). Weaving is effectively specified within houses where it is possible to break away from prior assumptions. It is also kept spatially separate from spinning, as the rooms that are centers for spinning rarely contain sizable deposits of loomweights (see table 4.8).

Spaces for Food Processing Food processing has few architectural constraints, only excluded from dark storerooms. It is less concentrated than weaving but slightly more so than spinning. The Communal Dining Service Building, the B3700-3900 building, the North Acropolis Building, the Northeast Building, The Service Building, the Southwest Building, and the East Corridor House all have a room or pair of rooms in which the food processing evidence is concentrated (see fig. 4.6).³⁸ These rooms generally have cooking features associated with them, including curbed hearths, ovens, and work platforms, all of which confirm generic associations among hearths, food processing, and food preparation.³⁹

Correlations in Spaces These three activities do not uniformly co-occur in space. Generally, spinning and food processing co-locate in the different rooms ($\rho = .87$). Both are time-consuming activities with the potential for scaling efficiencies as well as simultaneous social interaction. Although they do not share a *chaîne opératoire* in common, there is nevertheless an interpretable social logic behind the widespread co-location of these activities. The spaces identified by the excavators as kitchens are often the center of these activities (table 4.8). Although Foxhall has

³⁸The Northwest building also presently does, but the evidence is weak and liable to change once stone tools from the second campaign are cataloged, specifically from D1600-2, which is a kitchen..

³⁹Contra elements of Foxhall 2007a.



Figure 4.4: Probability distribution of spinning by building at Azoria. Darker shades of brown indicate higher probabilities.



Figure 4.5: Probability distribution of weaving by building at Azoria. Darker shades of brown indicate higher probabilities.



Figure 4.6: Probability distribution of food processing by building at Azoria. Darker shades of brown indicate higher probabilities.

Building	Spinning	Weaving	Food Processing
B3700-B3900 Building	B3800	B3800	B3800
Communal Dining Building		A1900S	
Communal Dining Service Building	A1600	A1600	A1600
D800	D800	D800	D800
East Corridor House		B1900b	
Monumental Civic Building		D0500	
North Acropolis Building	E0100		E0100
North Building			
Northeast Building		A2300	A2100
Northwest Building	D0700W	D1500W	D0700W
Service Building	B1500		B1500
South Building 2			
Southwest House	B3600		B3600
West Corridor House	G0300		B0300E

Table 4.8: The room with the highest expected probability from the spatial analysis. Empty cells indicate a tie.

questioned the validity and modern connotations of the term, the combination of spinning and food processing suggests a common center of intensive, social labor in buildings across the site.

This picture differs from the spatial distribution of weaving. Given the a priori negative correlation between hearths and weaving because of the indirect light requirement, it is unsurprising that there is a poor correspondence between weaving and food processing. The spatial differentiation between spinning and weaving, however, requires more explanation. The separation may reflect a division of labor or organizational preferences. In part, the decision to co-locate spinning with food processing prohibits a widespread trend to also co-locate with weaving. Spinning also has the potential to be social, while the collaborative elements of weaving are spatially and temporally constrained to include fewer people in particular spaces using specialized equipment.

Weaving appears in a combination of kitchens, vestibules, and halls; the strongest evidence for specification in the B3700-3900 building and the Northwest building occurs in halls. Cups, kraters, serving vessels, and cookpots characterize the halls at Azoria, as does their centrality within houses and their adjacency to storerooms.⁴⁰ The movement of foodstuffs between storerooms and kitchens

⁴⁰Haggis and Mook 2011: 370, 374, 377-80.

through halls, as well as the visible storage and presentation of food and drink in elaborate vessels, would have made these spaces highly formal spheres of interaction. Although it is impossible to reconstruct simultaneity of activity on any short scale, there is nevertheless a semantic connection made by locating formalized dining and weaving in the same space. In the houses where weaving is not concentrated in a hall, it is often in a corridor or vestibule, which seems unlikely as a permanent location for a loom, and may reflect movement or storage. In the Communal Dining Service Building, where there is no hall, weaving is instead concentrated in a kitchen.

Formal dining and weaving are spatially associated with each other and contrasted with food processing/preparation and spinning. This dichotomy associates the *chaîne opératoire* of two separate activities between rooms across the site; later stages are correlated with each other, while the time-consuming and labor-intensive earlier stages are in another room which is sometimes physically separated from the hall.⁴¹

4.5 Interaction and Organization at Archaic Azoria

Azoria was an interacting community of houses, institutionalized and embedded in the transformed topography of the site and the civic institutions that used the Communal Dining Building and the Monumental Civic Building.⁴² Across the site, the spatial and functional layout of houses is remarkably consistent. The use of linear axes of layout, the specification of function by room, and the syntax of the storeroom-hall-kitchen triad have been discussed elsewhere.⁴³ More than reflecting and shaping foodways alone, however, specification and the storeroom-hall-kitchen layout affect textile production as well, as demonstrated above. This arrangement is a choice, one that implies labor and status divisions in activity and imbues the physical structure of buildings with symbolic associations.

⁴¹Haggis and Mook 2011: 377.

⁴²Haggis 2014a.

⁴³Haggis and Mook 2011: 377-9; Haggis et al. 2011a: 477-485; Fitzsimons 2014.

4.5.1 Divisions of Gender and Dependency

Labor-intensive stages of production are consistently associated with one another across contexts at Azoria. Gender, status, dependency, and age are all possible organizing principles for the division of these activities, although no attribute would be exclusive or necessarily prohibit access to a space at all times of day or in all social contexts.⁴⁴ Gender is normally identified as determining the structure of household spaces because of references to female quarters of the house in Xenophon's *Oikonomia* and other sources.⁴⁵

The division present at Azoria does not likely reflect gender as an organizing principle. Spinning and weaving are affiliated with women from an early date, most notably in anecdotes in the *Iliad* and *Odyssey*, although as noted earlier these divisions may not be strongly codified in the Archaic period in practice.⁴⁶ While both works present a gendered ideal of female textile production, they also construct a distinction between work suitable for servants and work best done by wives alone. Queen Arete spins by the hearth of the palace (Od. 6.52-3), surrounded by female servants engaged in the same work. Penelope sits in the hall spinning by Telemachus (Od. 17.96-7); she also weaves unaided (Od. 2.94-109), as do Andromache (Il. 22.440-1) and Helen (Il. 3.125-8). Weaving is a task for women with status; spinning is undertaken by everyone.⁴⁷

Weaving separates elite women from domestic slaves. The presence of weaving in contexts of elite dining may emphasize adherence to gendered ideals for elite women.⁴⁸ Halls may also fit into the axis of gendered-ungendered space discussed by Nevett, whereby most spaces of the house are accessible to all members of the household, yet certain spaces can become male-only in the context of the symposium and similar dining practices.⁴⁹ At all times a connection of status is reaffirmed between the space and the activities therein. Weaving also hints at the labor investment in the

⁴⁴Fluid uses of space, and their identification, are discussed in sec. 2.2.

⁴⁵Nevett 1999; Coucouzeli 2007; Westgate 2007a.

⁴⁶See 1.1.1 and 2.4.

⁴⁷The earliest reference I have found to this observation is in Thurstan 1934, and has since been hinted at but rarely explicitly discussed. A notable exception is the portrayal of Briseis in Il. 1.29-31, who is taken as a captive who will weave back in Agamemnon's house in Argos.

⁴⁸Morris 1999.

⁴⁹Nevett 1999: 71-2.

creation of thread and references the weaver as master of the domestic servants. This connotation may include elite spinning as well, whereby markers such as dress or space would denote the spinner as manager of servants.

The associations between high status women and weaving as well as all women and spinning imply that a gender-centered organization of space would not have spatially separated these activities. I propose that divisions by status or class, however, would produce the record as observed. This does not rule out other hypotheses that have yet to be proposed; yet the strong epigraphic evidence for slavery in non-workshop contexts for Archaic and Classical Crete, coupled with functional associations organized by time investment and labor, suggest that food processing, cooking, and spinning were largely carried out by domestic slaves (*woikeis*, as contrasted with agricultural serfs).

Slaves are attested epigraphically at Gortyn for agricultural and domestic labor during the late Archaic and Classical periods, while at Eleutherna payment contracts indicate that groups of slaves were either owned by the city or rented out by their masters.⁵⁰ Slavery was not associated with specialized workshops on Crete as has been thought for Attica, but was primarily a legal and status distinction, one that maintained some personal autonomy but less than serfdom.⁵¹ The use of slaves for domestic labor, particularly textile production and cooking, is very generally attested in Greek literary sources as well.⁵²

Material evidence for slavery and dependent labor is notoriously difficult to isolate.⁵³ Divisions by gender, servitude, and family units can produce similar or even identical patterns of material distribution.⁵⁴ Multiple types of evidence must be used to distinguish between these hypotheses. Chattel slavery in particular can be detected by attempting to find similarities between the hybrid material culture of slaves and their original culture, but this requires a knowledge of probable origins and for slaves to be originally from other culture groups.⁵⁵ For Crete, slaves appear to

⁵⁰Perlman 2004: 110-1, 116-7.

⁵¹Perlman 2004: 103, 110-1. Contra Kyrtatas 2011: esp. 94.

⁵²Kyrtatas 2011: 105; Foxhall 2007a.

⁵³Ault 2007.

⁵⁴Castro-Martínez et al. 2013.

⁵⁵Morris 1998, 2011.

come from other poleis on the island as well as other regions, and material culture distinctions may not be visible or present, especially against the multi-ethnic background of Crete as a whole.⁵⁶

Slavery is an expectation for Crete in the Archaic period; the association of slaves with food production and spinning follows from the demonstrated status connotations of the tasks as well as standing in antithesis to the collocation of high status activities in other rooms of the house. I thus propose that the kitchens at Azoria, hubs of spinning and food processing, were primarily run by slaves, with probable oversight from other members of the household.

4.5.2 Slaves in Public Buildings

Beyond domestic contexts these divisions and associations grow more complex. The differences in scale and type of spinning between the Communal Dining Service Building and the Service Building, as well as the extra presence of bobbins in the Service Building, imply that more labor was invested in the production of textiles in the Service Building than in the Communal Dining Service Building. Further, the differences in food processing and preparation equipment link the Communal Dining Service Building more closely with the houses than with the Service Building. Given the probable model of state-supported and either publicly- or privately-owned slaves at Eleutherna, I propose that this model may also be profitably applied to Azoria.⁵⁷

The similarities between the kitchens of the Communal Dining Service Building and most other domestic contexts could result from the same people using them, namely the slaves of the houses. As part of the system of resource cycling between private and public contexts in the settlement, labor could also follow similar pathways. In addition to providing the Communal Dining Building with food, houses would provide slaves to work in the kitchens. This process would lead to the nearly homogeneous *habitus* for textile and food production implied by the equipment across these buildings. It also supports the model of an interacting set of households invested in codifying their identity as corporate groups, in that they are directly providing the resources and labor to sponsor

⁵⁶Perlman 2004: 128-30; Perlman 2014: 193-5, 203.

⁵⁷Perlman 2004.

and formalize their interactions.⁵⁸

In contrast, the Service Building operates according to different principles, on a larger scale, and produces food and threads in a qualitatively different manner. This alternate *habitus* could be explained by having a separate group of state-owned slaves who work solely in the civic facilities, namely the kitchens for the Monumental Civic Building and the Olive Press. The different *habitus* suggests an alternate learning context and thus a separate group of laborers. The Service Building is also one of the only locations on site that has direct evidence of butchery and skull caching, which implies an alternate path for meat preparation than the remainder of the site and a certain level of economic independence compared with the Communal Dining Service Building.

The identification of a public institution parallel and distinct from the Communal Dining Building, centered on the Monumental Civic Building, has long been implied in much of the scholarship concerning Azoria. The ideological differences between the modes of dining in these two buildings suggests opposing diacritical and unifying forces that also appear on the scale of the site in the conflicting messages between the erasure of the material record of prior settlement through extensive burying and the curation of older material in houses and civic buildings.⁵⁹ The greater independence of this institution from the house-based system of production and labor supply fits with this model of the socio-ideological dynamics.

The combination of political structures, parallel forms of social organization, and complex economic dependencies between civic buildings and houses necessitate variations in economic and labor strategies. While further excavation of houses at Azoria (particularly downslope) and other archaic sites will help constrain interpretations of these institutions at Azoria, I contend that slave labor is an applicable and consistent model for the evidence converting economic and social organization at Azoria.

⁵⁸Haggis 2014a: 135-8.

⁵⁹Fitzsimons 2014: 240-44.

4.5.3 A House Society

The armature of the spine walls across the site impose an unchanging urban plan in contrast to the agglomerated architecture of EIA sites.⁶⁰ Throughout the life of Azoria, individual rooms or buildings were abandoned, but the layout of houses was never notably changed. Status and gender associations could be mapped onto set spaces and extended into a cohesive grammar of spatial layout across the site. Continuity and symbolic meaning attributed to the physical house are both characteristics of Levi-Strauss' House society, in which people belong to Houses founded in legends from a heroic past, associated with particular ancestors, and containing heirlooms or objects associated with the materiality and origins of the house, while the people refer to each other using kinship language and metaphors.⁶¹ The house is a separate corporate entity from its membership at any one moment, instead emphasizing the maintenance and reproduction of long-term material, social, and cultural structures.⁶² Further, House societies may divide themselves into clans or lineages around single houses, which in turn both compete and cooperate on higher spatial and social scales. All of these attributes fit with the parallel institutionalized households of Azoria.

The House society model provides a working framework for the middle scale between the dispersed households that likely center on the acropolis houses at Azoria and the region. The retrieval and maintenance of old material in the city enables Houses to justify lineage claims and ancestral histories; similarly, heirlooms and armor in houses and the Communal Dining Building may have become physical reminders of this heritage and part of initiation or affirmation rituals in Houses.⁶³ Houses or clans may further rely on the local EIA topography to justify their claims: the architecture at Kavousi Kastro and Vronda supports a material encoding of family continuity, and spatial divisions at LMIIC and PG sites have been postulated to lead to later aspatial political and social units within early cities.⁶⁴ In short, the House society model fits the patterns of parallel

⁶⁰Haggis 2014a: 130.

⁶¹Beck Jr. 2007.

⁶²Gillespie 2007.

⁶³Haggis 2014a: 131; Lopiparo 2007: 74-5, 85-8; Kahn 2007: 199, 206.

⁶⁴Kastro: Mook 1998, 2011. Vronda: Day and Snyder 2000; Glowacki 2007. Compare also Karphi and Axos.

institutionalized yet dispersed households while also providing an interpretive framework for the reuse of past material and the use of heirlooms on site.

The House model does not inherently contain any notions of community integration, however. The range of cultures described as House societies includes settlements of single houses as well as cities of dozens. Community cohesion and identity beyond the House require other means of interaction and identification to be imposed on the House society background, which otherwise remains fairly competitive. Attributes such as status, class, or age can all provide this cross-cutting identity to unify these parallel social divisions into a single community.

One possible model for unifying structures in Archaic Cretan settlements is the age class, which divides the population into cohorts by birth year. This system is by far the most famous in Sparta, where it formed the unit of the *agelai*, but is also attested in Crete.⁶⁵ Age classes are used to construct degrees of citizenship and civic rights throughout the lifetime of citizens, in addition to unifying the population through discrete rituals with their age-mates. At Athens and Sparta, age classes predate the Archaic period and continue into at least the Classical period, albeit on an informal basis in Athens.⁶⁶ For Crete they are known as late as the third century BCE, and are probably tied to the Dorian system of tribes and civic government in some implementations.⁶⁷ The initiation of males into the citizen body is attested and effectively imposes one type of age class division onto the population.⁶⁸ Age classes are also common in House societies where initiation into the House is required. While other attributes such as status, gender, and dependency also helped organize Archaic Azoria, the less detectable yet attested age classes should not be forgotten as part of social organization.

These parallel and cross-cutting divisions allowed one to identify oneself and others within the settlement by multiple means. The Communal Dining Building provided the parallel structure to reinforce House or clan membership in a civic context, beyond the elite dining taking place within

Karphi: Wallace 2014; Day and Snyder 2000. Axos: Tegou 2014: 25-7. On the process: Attarian 2003; above, sec. 2.4.

⁶⁵Sallares 1991: 165-74.

⁶⁶Sallares 1991: 175-84.

⁶⁷Sallares 1991: 174.

⁶⁸Lefèvre-Novaro 2014; Erickson 2009.

the houses. Interestingly, its service building behaved similarly to a house in the means used to process food as well as the type of spinning that takes place. The Communal Dining Building itself also contained numerous krater stands similar to those found in the houses. In short, the Communal Dining Building and its service building operated like a single house (or House) on a larger scale and in a civic context. As the building likely received food and labor from the houses of the settlement, this propagated the organization of houses to the overall community, a common metaphor in House societies.

The Monumental Civic Building and Service Building, by contrast, invested significant labor in feeding and bringing together a larger group of people, either following class, tribe, or age class divisions. Notably the mode of production and interaction differs from every other context on site. This marked activities in both the Monumental Civic Building and Service Building and enabled the ideological contrast between the two forms of dining discussed above. This same marking requires effort to enforce, measured either in the amount of food required to feed the larger group, the labor required to process and prepare it, or the social efforts to continually reactivate this institution. If the group or groups meeting and dining in the Monumental Civic Building were divided along class or age class divisions, then the institution requires further organizational and social efforts to reproduce these same social structures in later generations. Although such cycles can become self-inducing, in the Spartan case this required immense resource expenditure on the part of individuals, which eventually led to the decline of the citizen body.⁶⁹

The incongruity between the organization of the Monumental Civic Building (and its Service Building) and the rest of the site, combined with the amount of resources and labor required to operate it, suggest that this institution may have been adopted or imposed upon an existing social framework that predated, in some sense, the transformation of the site. The building fits within the Dorian system of city organization for Crete, which structures civic affairs with tribes, age classes, and a central decision making body, often with individual magistrates in charge of each year.⁷⁰ The Dorians, however, were not a unified force, and many distinctions attributed in later periods to

⁶⁹Sallares 1991: 170, 173.

⁷⁰Hall 2007: 183-190.

the Dorian invasion may instead result from a common Mycenaean background.⁷¹ This latter view would fit with the culinary distinctions traced from LMIII, which support Mycenaean-descended dining practices.

Epigraphic evidence for tribe and calendar names in Classical and Hellenistic Cretan poleis suggests that the linguistic backgrounds of Cretan cities are diverse, as may be the underlying ethnic backgrounds of their institutions.⁷² The civic institutions at Azoria may reflect multiple origins and hompeting forces, namely divisions between houses based in local territories and requirements for community cohesion that accompany a new civic governmental structure. The paradigm of a Dorian invasion is basically untestable: adoption, immigration, and evolution are conflated, and within the forces of peer polity interaction all are possible. Assessing the ethnicity of individual houses, buildings, or people at Azoria is similarly untestable without evidence from graves, other houses, and comparative material from the region. The current material, however, supports at least the image of a multi-ethnic background in the social and economic structuring of Azoria.

⁷¹Hall 2007: 43-51.

⁷²Perlman 2014: 192-203.

Chapter 5

Social and Economic Transformations in Archaic Crete

The cultural and material transformation evident at Azoria has been identified with increasing frequency across Crete, particularly in other sites with Archaic abandonment.¹ The resulting complex social structure, however, is not present at all of these sites. Instead, there is a difference in the types of urbanism observed in Crete, visible in the growth of settlement clusters with probable ramifications for cultural and economic organization as well.² In this section, I briefly review the material evidence from the site of Prinias as a counter example to Azoria, Dreros, and other sites of higher social and political complexity.³ I then build a toy model that demonstrates a population threshold at which it becomes favorable to change from a family- or house-based form of social organization to one that uses large political or social divisions such as classes, with the implication that Azoria is a site that undergoes an analogous transition.

¹Gaignerot-Driessen and Driessen 2014.

²By settlement clusters I refer to regional populations affiliated with a set of settlements, as defined by Haggis and similar to the settlement chambers discussed in Whitley; see Haggis 2005: 149-52.

³Quantitative work in the same vein as for Azoria is forthcoming. For other work on the complex social system present in Archaic Crete see Wallace 2010: esp. 360.

5.1 Prinias

The site of Prinias in central Crete is a good example of a settlement that did not undergo the complex and thorough reorganization associated with Azoria. Although recent work has suggested that the site was materially elaborated over the course of the Geometric period, strong evidence for continuity in the house blocks suggests a gradual development that slowly integrated more communal functions that were symbolically and physically tied to the household.

Prinias was located on a flat hill top (the Patella) which overlooks the valley leading from Knossos to Gortyn. Near small villages in the Geometric period, Prinias became a larger Archaic settlement before being abandoned. Like many Archaic poleis, occupation at the town of Prinias began in LMIIC. The early discovery of two temples led to an extensive excavation of the surrounding houses and public spaces in order to understand the urban context of the buildings, and has largely determined the interests of scholarship for the site.

Temples A and B are located to the west of a large paved plaza which is surrounded by houses and architecturally delimited streets. The extensive sculptural program features seated goddesses wearing poloi as well as a frieze or set of orthostates that depict warriors riding elongated horses.⁴ Temple B had more fragmentary sculpture and may have been built at the same time as the surrounding houses, given its respect for their alignment. The pavement originally extended before temple B, with walls enclosing the rest of the space; before temple A could be constructed, several buildings had to be modified and walls flattened into ramps or low barriers.⁵

Temple A has been dated stylistically to ca. 625 and post-dates the construction of the other buildings because of its overlapping footprint and change in orientation.⁶ Both structures overlie earlier deposits of drinking and dining as far back as LMIIC, and although originally a PG gap was assumed between the two phases of cult, more recent excavation suggests that ritual deposits and dining continued throughout this period.⁷ The buildings are probably associated with elites, with

⁴Stucchi 1974; Rizza 1983.

⁵Rizza 2008: 300; Rizza et al. 2003; Lefèvre-Novaro et al. 2013.

⁶Rizza 2008: 300; Palermo 2001; Rizza 1983.

⁷Palermo 2001; Rizza et al. 2005.

extensive iconographic ties to orientalizing motifs perhaps adopted from the Syrian-Palestinian *marzeah*.⁸ The large open space before these temples, combined with the other public building of unclear function to the south of the plaza (VA-VE), suggests that some cult practice was publicly oriented or associated, however.⁹ Private contexts with hearths and dining debris were buried and modified to create new spaces when these temples were built, and combined with the presence of similar temples at Axos distinctly associated with the polis as an institution by the inscriptions on the building, the buildings are broadly considered to be public in nature, although that does not imply universal access or use.¹⁰

The houses at Prinias that surround this cluster of public buildings were explored over several campaigns. Early trenches by Pernier were supplemented with an extensive exploration of the plan of buildings by following walls, leaving rooms unexcavated until later seasons. As a result, few rooms were ever excavated, the plan has never been broken down into phases, and the evolution of the house blocks themselves is poorly understood.¹¹ Generic observations from the architecture suggest that the dense habitation of the settlement was organized according to either nuclear families or gene given the size and modular layout of houses within houseblocks.¹² The axial layout of hearth room and activity spaces serves as a template for the houses as well as the temples, and has much in common with respect to its plan with later Cretan houses.¹³

The houseblocks, however, do differ from Early Iron Age predecessors because of the complex patterns of reuse and phasing as well as the integration of cult spaces directly into the buildings. Room L in the north houseblock presents a fascinating evolution from a hearth-centered dining room into subdivided domestic spaces.¹⁴ The south houseblock integrates Temple C directly into its structure, contrary to the trends of bench shrines in earlier periods. Temple C further provides evidence for the non-agglutinative development of houseblocks, as Temple C respects earlier walls

⁸Carter 1997.

⁹The VA-VE building: Palermo et al. 2008; Pautasso 2014; Public cult, Kotsonas 2002; Sjögren 2007; Prent 2007.

¹⁰Palermo 2001; Sjögren 2007; Pautasso 2014; Tegou 2014.

¹¹Whitley 2009.

¹²Kotsonas 2002; Palermo 2001.

¹³Sjögren 2007; Palermo 2001; Westgate 2007a.

¹⁴Pautasso 2014.

and features yet does not appear to predate the construction of the northernmost house within the same block.

Beyond the settlement proper, several cemeteries of pithos graves and stone monuments are associated with the area.¹⁵ From PGB onward, cremation is a popular form of burial and becomes the dominant mode of burial by the seventh century.¹⁶ With the seventh century, grave stelai with engraved figures are displayed in the cemetery, and may be associated with the large rectangular monuments surrounded by pithos graves.¹⁷ Architectural fragments testify the elaboration of some of these monuments, although the majority were likely rubble piles with inset stelai.¹⁸ The Prinias stelai imitate embossed metal in their choice of depths and double outlines, and have been grouped into three major classes of iconography, namely warriors, matrons, and maidens.¹⁹ The latest stelai have been dated to the end of the 7th century, and the possibility of their simultaneous destruction with the building of Temple A has been interpreted as a political statement concerning the role of individuals in the community.²⁰

At the end of the 7th century, Prinias saw the construction of a new temple and the possible destruction of existing monuments in the local cemetery. These changes have been interpreted as a sudden transformation similar to the building and planning of Azoria.²¹ The gradual phases and spatial modifications of the houseblocks do not point to a rapid modification of the urban landscape; instead, the domestic sphere is largely untouched compared with previous phases, although some rooms continue to be modified or refloored.²² The numerous public buildings, some of which are physically integrated with the houseblocks and others organized in symbolically similar fashions, were added piecemeal to the settlement rather than in a single building event.²³ Further, the monuments and burials in the cemetery point to the possible emergence of a citizen class with

¹⁵Rizza 1974; Sporn 2014.

¹⁶Pautasso 2014; Kotsonas 2002.

¹⁷Rizza 1983; Lebessi 1976: 170.

¹⁸Lebessi 1974; Lebessi 1976: 169-70.

¹⁹Lebessi 1976: 167-8.

²⁰Kotsonas 2002: 43.

²¹Pautasso 2014.

²²Rizza 2008: 298-300.

²³Lefèvre-Novaro et al. 2013: 17.

basic gender and age distinctions and do not testify to the existence of a complex class structure.²⁴ Finally, the evidence for production in the area, best exemplified at Mandra di Gipari, supports a system based on households or gene without economic specialization.²⁵ At most, Prinias was only just developing public spheres of interaction and identity when it was destroyed; the radical makeover of Azoria is nowhere apparent.

5.2 A Model of Social Organization and Change

Gradual transition and rapid transformation are part of the narrative of Cretan urbanization.²⁶ Modeling these processes of growth, however, is still in its infancy, with recent work providing some of the initial models for how Archaic settlements urbanize through both continuity and change.²⁷ These provide necessary structure, but do not help explain differences between the types of change observed. I thus undertake a brief thought exercise that attempts to identify one possible explanation for the differences between Prinias and Azoria in their social and political development.

Social Networks

Over the course of the Geometric and Archaic periods, the social organization of settlements transitions from a household or family-centered mode of interaction to a system of class based interactions that enable the creation of a citizen identity.²⁸ For the purposes of a model, networks can represent these schemes in order to understand their social properties.

Network models are mathematically phrased as families of graphs that are alike in their structural properties but differ in their precise realizations. Often they have a core set of fundamental parameters (the number of people in the network, the average number of people each of them know, etc.) that constrain the realizations of that family of networks; further, these parameters

²⁴This is further supported by spatial analyses of the artifacts, forthcoming.

²⁵Rizza et al. 1992: 112.

²⁶Gaignerot-Driessen and Driessen 2014.

²⁷Wallace 2010; Gaignerot-Driessen 2013; ?.

²⁸Wallace 2010: 360.

enable explicit modeling and solutions to various questions.

The Network Model of a House Society In a House or family-centered society, interaction primarily occurs within houses, with limited interactions with other households. The Random Intersection Graph (often represented by the convention $G(N, M, p)$ and abbreviated RIG) describes a network in which the N people in a network belong to a subset of M different groups with probability of membership p .²⁹ Each person interacts with the others in their groups; each group contains an average of Np people and each person belongs to an average of Mp groups. By constraining these with plausible values, the model can be used to reflect the interactions of families in a network context.

The Network Model of a Civic or Class Society When social structure becomes codified in terms of classes or larger interacting organizational structures than families, divisions often become mutually exclusive; people can only belong to the citizen class or a non-citizen class, but not both. These divisions require an alternate mode of definition that describes the size of classes as well as their relations with other groups. The Stochastic Block model (represented by $G(N, M, \alpha_i, \pi_{i,j})$ and abbreviated SBM) describes N people who belong to one of M groups, with probability α_i of belonging to group i and probability $\pi_{i,j}$ of interacting with someone in group j . In a simplified version (SSBM), each group is equiprobable ($\alpha_i = \frac{1}{M}$) and all groups have identical properties ($\pi_{i,i} = p_{in}$ for all i and $\pi_{j,i} = \pi_{i,j} = p_{out}$ for all i, j). This enables simple modeling of similarly sized societal divisions, e.g. age classes or tribes.

Constraints on Models Although the families of network models are fairly broad, only a few apply to specific applications. For social networks, the average number of contacts a person can maintain is generally constrained to somewhere between 150 and 250 people; this represents the theoretical and observed extremes from a variety of surveys and data sources.³⁰ Further, the num-

²⁹For definition and exploration of properties, see Karoński et al. 1999; Fill et al. 2000; Stark 2004; Farrell et al. 2014.

³⁰Dunbar 1992; McCarty et al. 2001; Hernando et al. 2010.

ber of classes in the SSBM model and the mean family size of the RIG model can both be set to reflect ethnographically derived means or specific data for Crete; given Halstead's work on early 20th century agricultural groups in Greece, I assume a mean family size of 7, although the high variability of this needs to be incorporated in a future version of this model.³¹ I also assume that there are 5 classes or tribes for the SSBM, given the inscriptional evidence for civic subdivisions from Classical and Hellenistic Crete.³² These parameters can be varied in the analytic work in the future to assess the sensitivity of analyses to initial assumptions.³³

Socially Meaningful Metrics Broad societal inferences have informed the model up until this point. Decision making, however, is often conducted on an individual basis rather than on the level of communities. Network theory enables the average properties of individuals, however, to be inferred from the broader properties of the network.³⁴ Rather than exploring more complex descriptive statistics that are generally of interest in network science, I instead focus on two measures that approximate the ability of individuals to access the complete social network and the interconnectedness of relationships.

Non-mutual friends-of-friends Each individual in the network knows some number of people.

Each of those knows some group of people, some of whom the first individual does not know. The average size of this group determines the ability for connections to be exploited to reach other people in network.

Overlapping triangles per edge Each relationship described in the social network could be a positive or a negative relationship. Following the rules of structural stability in networks, each time that an existing relationship switches from negative to positive or vice versa, at minimum each triangle (a set of three people who all know each other) that contains that relationship must change to remain stable.³⁵

³¹Halstead 2014: 311, 318.

³²Perlman 2014.

³³This work is forthcoming.

³⁴One can also infer the distribution of properties, but this requires more space and work than there is space in this present chapter.

³⁵This is a technical sense of stability, such that a form of social logic is maintained. Specifically, the two stable

The ability to count on friends to reach other people in a large group of people is one social benefit of integrating into a social network; similarly, the requirement to change relationships with many people when becoming friends or enemies with someone is a social cost that comes with dense social networks. Treating these benefits and costs using the tools of behavioral psychology and game theory, the model can produce a glimpse into the social choices affecting societal organization. Further, these quantities are closely related to the possible internal schemata used to store social information, and thus may pertain to cognitive handling of social information as well.³⁶

5.2.1 Strategy and Decision Making

Game theory provides a standardized means to describe the process of decision making. It primarily functions by describing scenarios that contain choices with varying benefits and costs associated with them; in this case, the two strategies to consider are the two network models for societies listed above, while the costs and benefits are the measures described above. These costs and benefits can be weighted with different coefficients, e.g., c and b , to denote their importance in decision making. In the absence of other information, I consider them equally important; however, the power of such a model is that these parameters can be varied and explored in future work.

One great issue with game theory in the traditional sense is that it treats agents as “rational”, meaning that they make mathematically ideal choices every time and often have perfect access to information. This is blatantly untrue, and behavioral psychology has worked hard to arrive at better means of integrating human decision making into a game theory. One solution, namely prospect theory, includes approximations of how humans think of risk and probability as well as benefits and costs. Much of this emphasizes the importance of framing and the status quo as well as increased awareness of losses over gains (losing two dollars is more of an event than gaining two) and our diminishing sensitivity with increasing scale (earning 15 dollars rather than 10 dollars feels like a

configurations for triangles are best summarized by “the friend of my friend is my friend” and “the enemy of my enemy is my friend”. For a summary, see Newman 2010: 206-11.

³⁶Brashears 2013.

larger gain than earning 105 rather than 100.)³⁷

Using these perspectives, the benefits and costs of different forms of social organization can be contrasted over the growth and development of settlement. In figure 5.1, the utility functions are plotted for the two different network models under different constraints according to the overall size of the social network (N). These suggest that if a settlement starts out small and organized according to families, the most favorable initial strategy that maximizes access to the network while minimizing social costs is to encourage each individual to have a smaller number of contacts. As a settlement grows larger, it becomes increasingly favorable to have a larger number of contacts, until a critical threshold is passed. Beyond this point, it will always be more favorable to have as many contacts as possible.

Prospect theory enables this transition point to be investigated in greater detail. In figure 5.2, the same functions have been plotted, centered on the transition point and seen from the perspective of the lower number of contacts family strategy. This view emphasizes the undesirability of the higher contact network up until a certain population, when it becomes favorable rapidly to switch. Throughout, the most successful class or civic model always succeeds over all others, but requires people to know that it is an alternative and thus depends on information asymmetries that are not modeled here.³⁸

This toy model demonstrates that in the transition between family and civic societal organization schemes there is a natural intermediate stage, when a settlement has surpassed a critical population threshold, when it becomes increasingly favorable to gain more contacts and interact with more people in the settlement. Selection or preferences will no longer encourage decreasing numbers of contacts. From this point, the only remaining transition is to the civic model, which will happen whenever the option is known about and considered viable. This depends on information asymmetries between communities across the landscape, at present an under-investigated topic. It is probable, however, that this choice will only be viable above the threshold noticed in the model, when the benefits of larger networks are already being chosen and selected for.

³⁷Kahneman and Tversky 1979; Tversky and Kahneman 1986, 1991, 1992.

³⁸Hayek 1945.

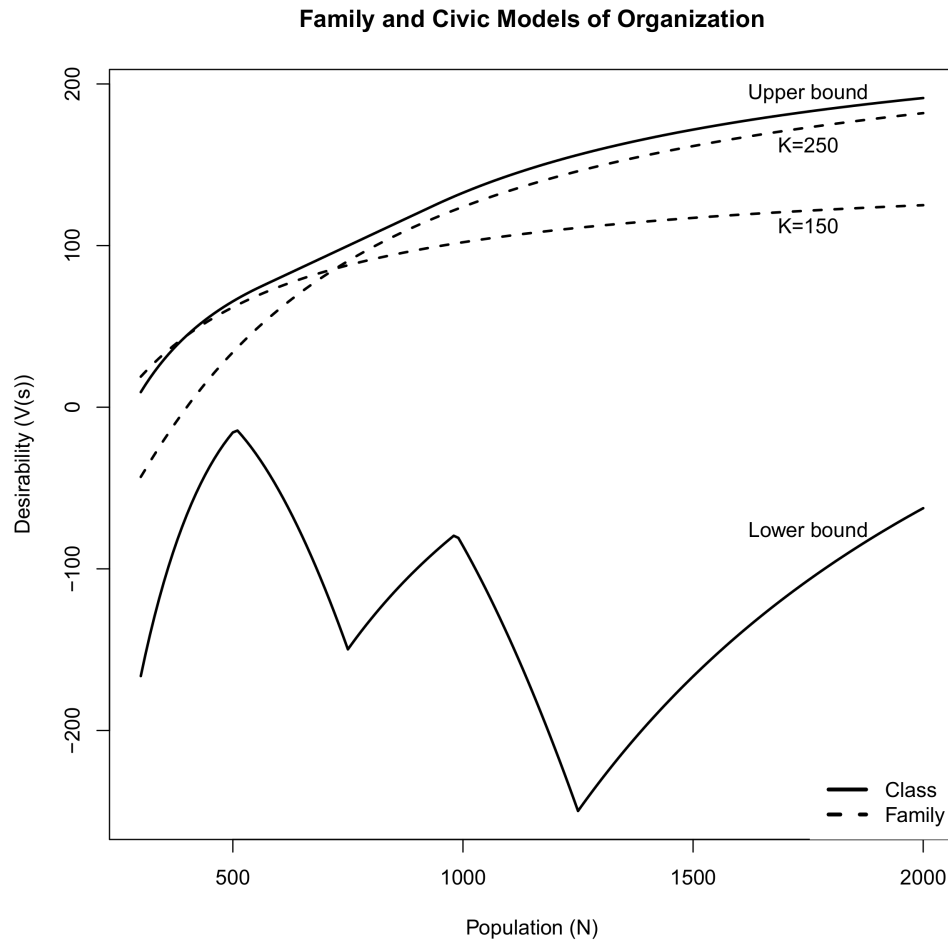


Figure 5.1: Benefits of the different social organizational schemes. Benefits are defined as the benefits of social interaction minus the costs of conflict in the system. The numerical scale is unitless and fundamentally meaningless; the numerics enable qualitative dynamics and orders of magnitude to be established, not precise predictions.

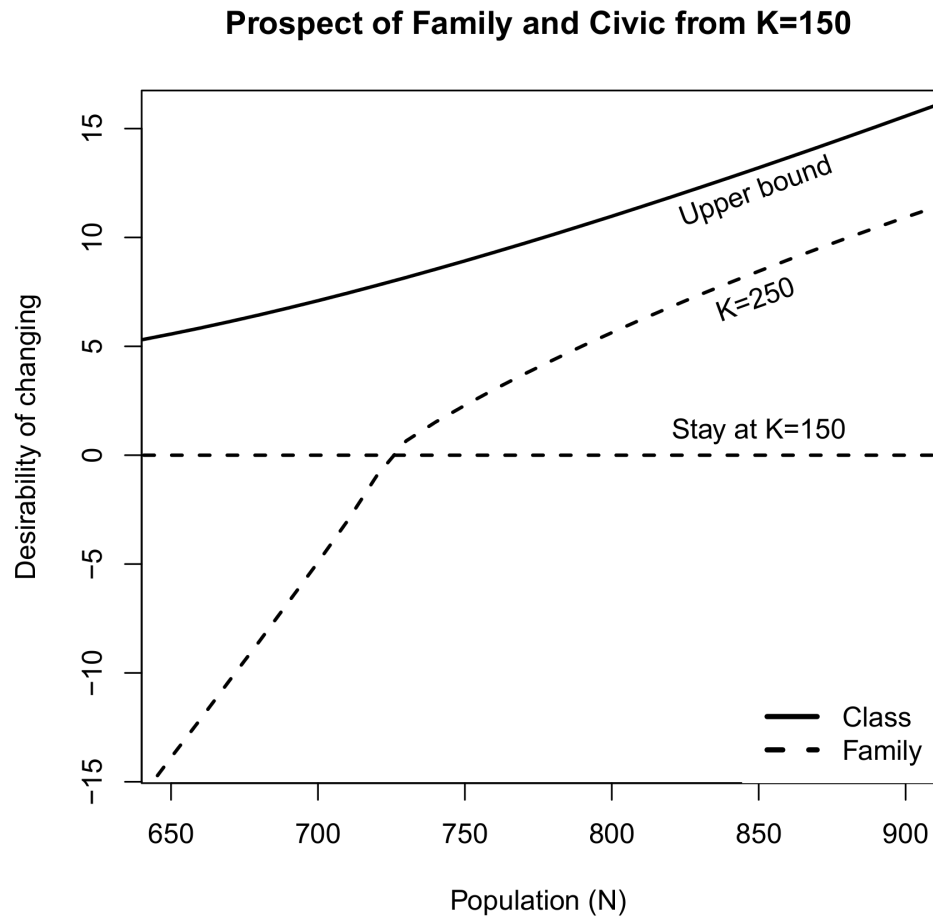


Figure 5.2: Benefits of having more contacts in a family-organized society or switching to a class-oriented society.

Through the lens of prospect theory, the choice becomes desirable at a certain threshold and then becomes rapidly more favorable. The upper bound of the class model is always higher, but requires people to know it exists (the problem of asymmetric information.)

The exact parameters of the model will affect the precise moment at which this threshold occurs. With the current parameters, this threshold occurs around $N = 725$. While population estimates are notoriously difficult and unreliable, I note that population is one dimension that separates Azoria and Prinias, as Archaic Azoria has a probable population of somewhere between 1000 and 1500, while Prinias is significantly smaller.

This model is one of several that could be constructed to conceptualize and visualize the urban transition in Archaic Crete. Population growth is certainly not the only reason that transitions such as this can occur; even within this model, changing ideas about family size or civic organization could lead to similar or other transitions. Its use lies in the ability to independently conceptualize and examine the workings of a social system of interest, simplifying it to a point at which some interesting behaviors of interest still exist.

5.3 Urbanism in Archaic Crete

Archaic urbanism is not the predecessor to Classical urbanism in a developmental sense, wherein it displays muted or early forms of later structures in a linearly predictable fashion. The evidence for class distinctions solidifying before gendered divisions of space and the competing tensions between governmental and familial structures make Azoria a fundamentally different, not less complex, form of settlement than later cities. The simple model of social transformation explored above suggests that broader differences in political and social organization may follow from fundamental constraints on human information processing and the size of social systems. The maintenance of house society organizational schema even while civic structures are constructed, the division of labor and its separation within buildings, and the rapidity of the transformation at Azoria contrast markedly with the other best documented case of Archaic urbanism in Crete, namely Prinias, and do not follow from simplistic developmental models.

Kotsonas proposes that Cretan urbanism was aided by a consensus among elites that empha-

sized cohesion over competition and altered arenas of interaction to promote these values.³⁹ The few changes in settlement structure at Prinias certainly fit this model; the tension between house and civic society at Azoria does not. Further, no model explains generative or maintenance processes for labor division or the dynamics of houses within the civic system. In short, our understanding of Cretan settlements as human communities has much to gain from more detailed social and economic analyses. Approaches that account for diversity and agency but have the rigor to analyze real data will enable a more nuanced and complete understanding of Cretan urbanism; this work hopes to have established a starting point for this study.

³⁹Kotsonas 2002.

Bibliography

- (1974). *Antichità Cretesi. Studi in onore di Doro Levi*, volume II. Università di Catania - Istituto di Archeologica.
- Alexander, R. T. (1999). Mesoamerican House Lots and Archaeological Site Structure: Problems of Inference in Yaxcaba, Yucatan, Mexico, 1750-1847. In Allison (1999), pages 78–100.
- Allison, P. M., editor (1999). *The Archaeology of Household Activities*. Routledge.
- Antonaccio, C. M. (1995). Lefkandi and Homer. In Andersen, O. and Dickie, M., editors, *Homer's World*. Bergen.
- Antonaccio, C. M. (2000). Architecture and Behavior: Building Gender into Greek Houses. *The Classical World*, 93(5):pp. 517–533.
- Attarian, C. J. (2003). Cities as a Place of Ethnogenesis: Urban Growth and Centralization in the Chicama Valley, Peru. In Smith (2003b), pages 156–211.
- Ault, B. A. (2000). Living in the Classical Polis: The Greek House as Microcosm. *The Classical World*, 93(5):483–496.
- Ault, B. A. (2007). Oikos and Oikonomia: Greek houses, households and the domestic economy. In Westgate and Whitley (2007), pages pp. 259–265.
- Ault, B. A. and Nevett, L. C., editors (2005). *Ancient Greek houses and households: chronological, regional, and social diversity*. University of Pennsylvania Press.
- Barber, E. W. (1995). *Women's work: The first 20,000 years: Women, cloth, and society in early times*. WW Norton & Company.
- Barrett, J. A. (2006). Numerical simulations of the Lewis signaling game: Learning strategies, pooling equilibria, and the evolution of grammar.
- Barrett, J. A. (2007). Dynamic Partitioning and the Conventionality of Kinds. *Philosophy of Science*, 74(4):pp. 527–546.
- Beck Jr., R. A. (2007). The Durable House: Material, Metaphor, and Structure. In Robin A. Beck (2007), pages 3–24.
- Bendall, L. (2004). Fit For a King? Hierarchy, Exclusion, Aspiration and Desire in the Social Structure of Mycenaean Banqueting. In Halstead and Barrett (2004), pages 105–135.

- Bettencourt, L. M. A. (2013). The Origins of Scaling in Cities. *Science*, 340(6139):1438–1441.
- Birch, J., editor (2013). *From prehistoric villages to cities : settlement aggregation and community*. Routledge, Taylor & Francis Group.
- Blegen, C. W. (1963). *Troy and the Trojans*. Frederick A. Praeger.
- Borgna, E. (1997). Kitchen-Ware from LM IIIC Phaistos. Cooking Traditions and Ritual Activities in LBA Cretan Societies. *Studi micenei ed egeo-anatolici*, 39(2):189–218.
- Borgna, E. (2003). Regional settlement patterns, exchange systems and sources of power in Crete at the end of the Late Bronze Age: establishing a connection. *Studi micenei ed egeo-anatolici*, 45(2):153–183.
- Borgna, E. (2004a). Aegean feasting: A Minoan perspective. *Hesperia*, pages 247–279.
- Borgna, E. (2004b). Social Meaning of Food and Drink Consumption in LMIII Phaistos. In *Food, Cuisine and Society in Prehistoric Greece (Sheffield Studies in Aegean Archaeology 5)*, pages 174–195. Oxbow Books.
- Bradley, K. and Cartledge, P., editors (2011). *The Cambridge World History of Slavery*, volume 1. Cambridge University Press. Cambridge Histories Online.
- Brashears, M. E. (2013). Humans Use Compression Heuristics to Improve the Recall of Social Networks. *Scientific Reports*, 3(1513):1–7.
- Braun, D. P. (1983). Pots as Tools. In Moore, J. A. and Keene, A. S., editors, *In Archaeological Hammers and Theories*, pages 107–134. Academic Press, New York.
- Brogan, T., Sofianou, C., Morrison, J., Mylona, D., and Margaritis, E. (2013). Living off the fruits of the sea: new evidence for dining at Papadiokampos, Crete. In Voutsaki and Valamoti (2013), pages 123–132.
- Burke, B. (2008). The Kingdom of Midas and Royal Cloth Production. In Nosch and Gillis (2008), pages 64–70.
- Burke, B. (2010). *From Minos to Midas: Ancient Cloth Production in the Aegean and in Anatolia*. Oxbow Books.
- Cahill, N. (2000). Olynthus and Greek Town Planning. *The Classical World*, 93(5):pp. 497–515.
- Cahill, N. (2005). Household Industry in Greece and Anatolia. In Ault and Nevett (2005), pages 54–66.
- Cameron, C. (1998). Coursed Adobe Architecture, Style, and Social Boundaries in the American Southwest. In Stark (1998b), pages 183–208.
- Carneiro, R. L. (1962). Scale Analysis as an Instrument for the Study of Cultural Evolution. *Southwestern Journal of Anthropology*, 18(2):pp. 149–169.

- Carneiro, R. L. (1967). On the Relationship between Size of Population and Complexity of Social Organization. *Southwestern Journal of Anthropology*, 23(3):234–243.
- Carter, J. B. (1997). Thiasos and marzeah: Ancestor cult in the age of Homer. *New light on a dark age*, pages 72–112.
- Castro-Martínez, P. V., Escanilla-Artigas, N., Escoriza-Mateu, T., Oltra-Puigdomènech, J., and Sarkis-Fernández, D. (2013). Domestic Units, Definition and Multiform Archaeological Appearance. Economy and Politics in Unlike Domestic Prehistoric Groups of the Western Mediterranean. Oxbow Books.
- Cavanagh, W. (1991). Surveys, Cities, and Synoecism. In Rich and Wallace-Hadrill (1991).
- Chilton, E. S. (1998). The Cultural Origins of Technical Choice: Unraveling Algonquian and Iroquoian ceramic traditions in the Northeast. In Stark (1998b), pages 132–160.
- Chomsky, N. (1956). Three models for the description of language. *Information Theory, IRE Transactions on*, 2(3):113–124.
- Clarke, M. J. (2001). Akha Feasting: An Ethnoarchaeological Perspective. In Dietler and Hayden (2001), pages 144–167.
- Coucouzeli, A. (2007). From megaron to oikos at Zagora. In Westgate and Whitley (2007), pages 169–181.
- Cover, T. M. and Thomas, J. A. (2006). *Elements of information theory*. John Wiley & Sons.
- Cowgill, G. L. (2003). Teotihuacan: Cosmic Glories and Mundane Needs. In Smith (2003b), pages 37–55.
- Crielaard, J. (2009). Cities. In Raaflaub and Van Wees (2009), pages 349–372.
- Curtis, R. I. (2001). *Ancient Food Technology*, volume 5 of *Technology and Change in History*, chapter six: The Greek World: Bronze Age Through the Hellenistic Period, pages 259–322. Brill.
- Danner, P. (1997). Megara, Megara Hyblaea and Selinus: the Relationship between the Town Planning of a Mother City, a Colony, and a Sub-Colony in the Archaic Period. chapter Urbanization in late and sub-geometric greece: abstract considerations and concrete case studies of Eretria and Zagora c. 700 BC., pages 143–166. Museum Tusculanum.
- Davies, J. K. (1997). The 'Origins of the Greek Polis': Where should we be looking? pages 24–38. Routledge.
- Day, L. P., Mook, M. S., and Muhly, J. D., editors (2004). *Crete beyond the palaces: proceedings of the Crete 2000 Conference*, volume 10. Institute for Aegean Prehistory Press.
- Day, L. P. and Snyder, L. M. (2000). The 'Big House' at Vronta and the 'Great House' at Karphi: Evidence for Social Structure in LM IIIC Crete. In Day et al. (2004), pages 63–79.

- De Polignac, F. (2005). *Forms and Processes: Some Thoughts on the Meaning of Urbanization in Early Archaic Greece*. Oxford University Press.
- Dibble, F. (2013). Azoria 2013 Zooarchaeological Preliminary Report. Technical report, INSTAP-SCEC.
- Dietler, M. (2001). Theorizing the Feast: Rituals of Consumption, Commensal Politics, and Power in African Contexts. In Dietler and Hayden (2001), pages 65–114.
- Dietler, M. and Hayden, B., editors (2001). *Feasts: Archaeological and Ethnographic Perspectives on Food, Politics, and Power*. Smithsonian Institution Press.
- Dietler, M. and Herbich, I. (1998). Habitus, Techniques, Style: An Integrated Approach to the Social Understanding of Material Culture and Boundaries. In Stark (1998b), pages 232–263.
- Dietler, M. and Herbich, I. (2001). Feasts and Labor Mobilization: Dissecting a Fundamental Economic Practice. In Dietler and Hayden (2001), pages 240–264.
- Driessen, J. (2009). Daidalos' Designs and Ariadne's Threads: Minoan Towns as Places of Interaction. In Owen and Preston (2009), pages 41–54.
- Duffy, P. R., Parkinson, W. A., Gyucha, A., and Yerkes, R. W. (2013). Coming Together, Falling Apart: A Multiscalar Approach to Prehistoric Aggregation and Interaction on the Great Hungarian Plain. In Birch (2013).
- Dunbar, R. I. (1992). Neocortex size as a constraint on group size in primates. *Journal of Human Evolution*, 22(6):469–493.
- Düring, B. S. (2007). The Articulation of Houses at Neolithic Catalhöyük, Turkey. In Robin A. Beck (2007), pages 130–153.
- Düring, B. S. (2013). The Anatomy of a Prehistoric Community: Reconsidering Çatalöyük. In Birch (2013).
- Eaby, M. S. (2013). Azoria 2002-2006 Small Finds Catalog.
- Ebbinghaus, S. (2005). Protector of the city, or the art of storage in Early Greece. *The Journal of Hellenic Studies*, pages 51–72.
- Erickson, B. (2009). Roussa Ekklesia, Part 1: Religion and Politics in East Crete. *American Journal of Archaeology*, 113(3):353–404.
- Everett, D. L. (2012). *Language: The cultural tool*. Random House Digital, Inc.
- Farrell, M., Goodrich, T., Lemons, N., Reidl, F., Villaamil, F. S., and Sullivan, B. D. (2014). Hyperbolicity, degeneracy, and expansion of random intersection graphs. [abs/1409.8196](https://arxiv.org/abs/1409.8196).
- Fiedler, M. (2005). Houses at Leukas in Acarnania: A Case Study in Ancient Household Organization. In Ault and Nevett (2005), pages 99–118.

- Fill, J. A., Scheinerman, E. R., and Singer-Cohen, K. B. (2000). Random intersection graphs when $m = \omega(n)$: An equivalence theorem relating the evolution of the $G(n, m, p)$ and $G(n, p)$ models. *Random Structures & Algorithms*, 16(2):156–176.
- Fitzjohn, M. (2007). Searching for the domestic: investigations of the built environment in Iron Age and Archaic Sicily. In Westgate and Whitley (2007), pages pp. 201–204.
- Fitzsimons, R. D. (2014). Urbanization and the Emergence of the Greek Polis: The Case of Azoria, Crete. In Creekmore III, A. T. and Fisher, K. D., editors, *Making Ancient Cities: Space And Place In Early Urban Societies*, pages 220–256. Cambridge University Press.
- Fletcher, R. (2007). *The limits of settlement growth: A theoretical outline*. Cambridge University Press.
- Fox, R. (2012). Symbols of the Feasts: Elite Ideology and Feasting Practices in Early Iron Age Greece. In *Food and Drink in Archaeology 3*, pages 33–40. Prospect Books.
- Foxhall, L. (1995). Bronze to iron: Agricultural systems and political structures in late Bronze Age and early Iron Age Greece. *The annual of the British School at Athens*, pages 239–250.
- Foxhall, L. (2007a). House clearance: unpacking the 'kitchen' in Classical Greece. In Westgate and Whitley (2007), pages pp. 233–242.
- Foxhall, L. (2007b). *Olive cultivation in ancient Greece*.
- Frankel, R. (1999). *Wine and Oil Production in Antiquity in Israel and Other Mediterranean Countries*. Number 10 in JSOT/ASOR Monograph Series. Sheffield Academic Press.
- Gaignerot-Driessen, F. (2013). *From postpalatial occupation to the Greek city-state: a case study of the Mirabello region (East Crete)*. PhD thesis, University of Paris-Sorbonne, Paris.
- Gaignerot-Driessen, F. and Driessen, J., editors (2014). *Cretan Cities: Formation and Transformation*. Presses universitaires de Louvain.
- Garnsey, P. and Morris, I. (1989). Risk and the polis: the evolution of institutionalised responses to food supply problems in the ancient Greek state. In *Bad year economics: Cultural responses to risk and uncertainty*, pages 98–105.
- Gillespie, S. D. (2007). When is a House? In Robin A. Beck (2007), pages 25–50.
- Glowacki, K. (2007). House, household and community at LM IIIC Vronda, Kavousi. In Westgate and Whitley (2007), pages pp. 129–139.
- Glowacki, K. T. (2000). Household Analysis in Dark Age Crete. In Day et al. (2004), pages 125–136.
- Glowacki, K. T. and Vogeikoff-Brogan, N., editors (2011). *Stega: The Archaeology of Houses and Households in Ancient Crete*. Hesperia Supplement 44. The American School of Classical Studies at Athens.

- Gold, E. M. (1967). Language identification in the limit. *Information and control*, 10(5):447–474.
- Goldberg, M. Y. (1999). Spatial and Behavioral Negotiation in Classical Athenian City Houses. In Allison (1999), pages 142–161.
- Goodby, R. G. (1998). Technological Patterning and Social Boundaries: Ceramic Variability in Southern New England, A.D. 1000-1675. In Stark (1998b), pages 161–183.
- Gosselain, O. P. (1998). Social and Technical Identity in a Crystal Ball. In Stark (1998b), pages 78–106.
- Griffiths, D. M. (1978). Use-marks on historic ceramics: a preliminary study. *Historical Archaeology*, pages 68–81.
- Haggis, D. (2013a). *Destruction: Archaeological, philological and historical perspectives*, chapter Destruction and the formation of static and dynamic settlement structures, pages 61–84. Presses Universitaires de Louvain, Louvain-la-Neuve.
- Haggis, D. (2013b). Social Organization and Aggregated Settlement Structure in an Archaic Greek City on Crete. In Birch (2013), pages 63–86.
- Haggis, D. C. (2005). *Kavousi I: The Archaeological Survey of the Kavousi Region*. Prehistory Monographs 16. INSTAP Academic Press.
- Haggis, D. C. (2007). Stylistic diversity and diacritical feasting at Protopalatial Petras: A preliminary analysis of the Lakkos deposit. *American Journal of Archaeology*, pages 715–775.
- Haggis, D. C. (2014a). Azoria and Archaic Urbanization. In Gaignerot-Driessen and Driessen (2014), pages 119–140.
- Haggis, D. C. (2014b). Excavations at Azoria and Stratigraphic Evidence for the Restructuring of Cretan Landscapes ca. 600 BCE. In Pilz and Seelentag (2014), pages 11–40.
- Haggis, D. C., Carter, T., Mook, M. S., and Snyder, L. M. (2007a). Excavations At Azoria, 2003-2004, Part 2 The Final Neolithic, Late Prepalatial, And Early Iron Age Occupation. *Hesperia*, 76(4):665–716.
- Haggis, D. C. and Mook, M. S. (2011). The Archaic Houses at Azoria. In Glowacki and Vogeikoff-Brogan (2011).
- Haggis, D. C., Mook, M. S., Fitzsimons, R. D., Scarry, C. M., and Snyder, L. M. (2011a). The Excavation of Archaic Houses at Azoria in 2005–2006. *Hesperia*, 80(3):431–489.
- Haggis, D. C., Mook, M. S., Fitzsimons, R. D., Scarry, C. M., Snyder, L. M., STEFANAKIS, M. I., and WEST, W. C. (2007b). Excavations at Azoria, 2003-2004, Part 1: The Archaic Civic Complex. *Hesperia*, 76(2):243–321.
- Haggis, D. C., Mook, M. S., Fitzsimons, R. D., Scarry, C. M., Snyder, L. M., and West III, W. C. (2011b). Excavations in the Archaic Civic Buildings at Azoria in 2005-2006. *Hesperia*, 80(1):1–70.

- Hall, J. M. (2007). *A history of the archaic Greek world, ca. 1200-479 BCE*. Blackwell.
- Hally, D. J. (1983). Use alteration of pottery vessel surfaces: an important source of evidence for the identification of vessel function. *North American Archaeologist*, 4(1):3–26.
- Hally, D. J. (1986). The Identification of Vessel Function: A Case Study from Northwest Georgia. *American Antiquity*, 51(2):pp. 267–295.
- Halstead, P. (2014). *Two Oxen Ahead: Pre-Mechanized Farming in the Mediterranean*. John Wiley & Sons.
- Halstead, P. and Barrett, J. C., editors (2004). *Food, Cuisine and Society in Prehistoric Greece (Sheffield Studies in Aegean Archaeology 5)*. Oxbow Books.
- Hamilakis, Y. (2000). The Anthropology of Food and Drink Consumption and the Aegean Archaeology. pages 55–64. Oxbow Books.
- Hansen, M. H. (2004). The Use of Sub-Ethnics as Part of the Name of a Greek Citizen of the Classical Period: The Full Name of a Greek Citizen. Number 7 in Papers from the Copenhagen Polis Centre, pages 117–130. Franz Steiner Verlag.
- Hansen, M. H. (2006a). *Polis : an introduction to the ancient Greek city-state*. Oxford University Press.
- Hansen, M. H. (2006b). *The shotgun method: the demography of the ancient Greek city-state culture*. University of Missouri.
- Hansen, M. H. and Fischer-Hansen, T. (1994). Monumental political architecture in Archaic and Classical Greek poleis. Evidence and historical significance. In *From Political Architecture to Stephanus Byzantius: Sources for the Ancient Greek Polis*, pages 23–90.
- Hansen, M. H. and Nielsen, T. H., editors (2004a). *An inventory of archaic and classical poleis*. Oxford University Press.
- Hansen, M. H. and Nielsen, T. H. (2004b). Civic Subdivisions. In Hansen and Nielsen (2004a).
- Hansen, M. H. and Nielsen, T. H. (2004c). The Polis as an Urban Center. In Hansen and Nielsen (2004a), pages 138–.
- Hayden, B. (2001). Fabulous Feasts: A Prolegomenon to the Importance of Feasting. In Dietler and Hayden (2001), pages 23–64.
- Hayek, F. A. (1945). The use of knowledge in society. *The American Economic Review*, 35(4):519–530.
- Hegmon, M. (1998). Technology, Style, and Social Practices: Archaeological Approaches. In Stark (1998b), pages 264–280.
- Heitman, C. C. (2007). Houses Great and Small: Reevaluating the “House” in Chaco Canyon, New Mexico. In Robin A. Beck (2007), pages 248–272.

- Herman, G. (1987). *Ritualised Friendship and the Greek City*. Cambridge University Press, Cambridge.
- Hernando, A., Villuendas, D., Vesperinas, C., Abad, M., and Plastino, A. (2010). Unravelling the size distribution of social groups with information theory in complex networks. *The European Physical Journal B*, 76(1):87–97.
- Hillier, B. (1999). The hidden geometry of deformed grids: or, why space syntax works, when it looks as though it shouldn't. *Environment and Planning B: Planning and Design*, 26:169–191.
- Hillier, B. (2007). Space is the machine: a configurational theory of architecture.
- Hillier, B. (2012). Studying cities to learn about minds: some possible implications of space syntax for spatial cognition. *Environment and Planning B*.
- Hillier, B., Hanson, J., and Graham, H. (1987). Ideas are in things-An application of the space syntax method to discovering house genotypes. *ENVIRON PLANN B*, 14(4):363–385.
- Hillier, B., Penn, A., Hanson, J., Grajewski, T., and Xu, J. (1993). Natural Movement-or, configuration and attraction in urban pedestrian movement. *Environ Plann B*, 20(1):29–66.
- Hodder, I. and Cessford, C. (2004). Daily Practice and Social Memory at Çatalhöyük. *American Antiquity*, 69(1):pp. 17–40.
- Houston, S. D., Escobedo, H., Child, M., Golden, C., and Muñoz, R. (2003). The Moral Community: Maya Settlement Transformation at Piedras Negras, Guatemala. In Smith (2003b), pages 212–253.
- Jacobs, J. (1961). *The death and life of great American cities*. Random House, New York.
- Jaynes, E. T. (1974). *Probability Theory*.
- Jones, G. (1987). Agricultural Practice in Greek Prehistory. *The Annual of the British School at Athens*, 82:pp. 115–123.
- Kahn, J. G. (2007). Power and Precedence in Ancient House Societies: A Case Study from the Society Island Chiefdoms. In Robin A. Beck (2007), pages 198–223.
- Kahneman, D. (2011). *Thinking, fast and slow*. Macmillan.
- Kahneman, D. and Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, 47(2):263–292.
- Kaplan, M. F. (1986). Mankind's Future: Using the Past To Protect the Future Archaeology and the Disposal of Highly Radioactive Wastes. *Interdisciplinary Science Reviews*, 11(3):257–268.
- Karoński, M., Scheinerman, E. R., and Singer-Cohen, K. B. (1999). On Random Intersection Graphs: The Subgraph Problem. *Comb. Probab. Comput.*, 8(1-2):131–159.
- Knappett, C. (2004). Technological innovation and social diversity at Middle Minoan Knossos. *British School at Athens Studies*, 12:pp. 257–265.

- Kotsonas, A. (2002). The Rise of the Polis in Central Crete. *Eulimene*, 3:37–74.
- Kyrtatas, D. J. (2011). Slavery and economy in the Greek world. In Bradley and Cartledge (2011), pages 91–111. Cambridge Histories Online.
- LaMotta, V. M. and Schiffer, M. B. (1999). Formation Processes of House Floor Assemblages. In Allison (1999), pages 19–29.
- Lang, F. (2007). House - community - settlement: the new concept of living in Archaic Greece. In Westgate and Whitley (2007), pages 183–193.
- Langdon, S. (2013). Children as Learners and Producers in Early Greece. In Grubbs, J. E. and Parkin, T., editors, *The Oxford Handbook of Childhood and Education in the Classical World*. Oxford University Press.
- Lawrence, S. (1999). Towards a Feminist Archaeology of Households: Gender and Household Structure on the Australian Goldfields. In Allison (1999), pages 121–141.
- Lebessi, A. (1974). Monumento funerario del VIII s.a.C. a Creta. In *ant* (1974), pages 120–128.
- Lebessi, A. C. (1976). *Oi Steles tou Prinias*.
- Lefèvre-Novaro, D. (2014). La naissance de la polis de Phaistos: Du site mycénien à la cité dorienne. In Gaignerot-Driessen and Driessen (2014), pages 43–58.
- Lefèvre-Novaro, D., Pautasso, A., Rizza, S., and Lamaze, J. (2013). Dreros e Prinias: nuovi dati e prospettive di ricerca sulla polis a Creta. *Thiasos*, 2:3–20.
- Legge, G. E., Pelli, D. G., Rubin, G. S., and Schleske, M. M. (1985). Psychophysics of reading-I. Normal vision. *Vision Research*, 25(2):239 – 252.
- Lopiparo, J. (2007). House Societies and Heterarchy in the Terminal Classic Ulúa Valley, Honduras. In Robin A. Beck (2007), pages 73–96.
- Lynch, K. (1960). *The image of the city*. MIT press.
- Lynch, K. M. (2007). More thoughts on the space of the symposium. In Westgate and Whitley (2007), pages pp. 243–249.
- Lynch, K. M. (2011). *The Symposium in Context: Pottery from a Late Archaic House near the Athenian Agora*. Hesperia Supplement.
- Maceachern, S. (1998). Scale, Style, and Cultural Variation: Technological Traditions in the Northern Mandara Mountains. In Stark (1998b), pages 107–131.
- MacKay, D. J. (2003). *Information theory, inference and learning algorithms*. Cambridge university press.
- Mackil, E. (2004). Wandering cities: Alternatives to catastrophe in the Greek polis. *American Journal of Archaeology*, pages 493–516.

- Mann, K. (2015). Mutable Spaces and Unseen Places: A Study of Access, Communication and Spatial Control in Households at Early Iron Age (EIA) Zagora on Andros.
- Martinez-Sève, L. (2014). The Spatial Organization of Ai Khanoum, a Greek City in Afghanistan. *American Journal of Archaeology*, 118(2):267–283.
- Mazarakis-Ainian, A. (2007). Architecture and social structure in Early Iron Age Greece. In Westgate and Whitley (2007), pages pp. 157–168.
- Mazarakis Ainian, A., editor (2011). *The “Dark Ages” Revisited. Acts of an international symposium in memory of William D. E. Coulson*. University of Thessaly Press.
- McCarty, C., Killworth, P. D., Bernard, H. R., Johnsen, E. C., and Shelley, G. A. (2001). Comparing Two Methods for Estimating Network Size. *Human Organization*, 60:28–39.
- McDonald, W., Coulson, W., and Rosser, J. (1983). *Excavations at Nichoria in Southern Greece: Dark age and Byzantine occupation*. Number v. 3. The University of Minnesota press.
- McIntosh, R. J. and McIntosh, S. K. (2003). Early Urban Configurations on the Middle Niger: Clustered Cities and Landscapes of Power. In Smith (2003b).
- McKee, B. R. (1999). Household Archaeology and Cultural Formation Processes: Examples from the Céren Site, El Salvador. In Allison (1999), pages 30–42.
- McLoughlin, B. (2011). The Pithos Makers At Zagora: Ceramic Technology And Function In An Agricultural Settlement Context. In Mazarakis Ainian (2011).
- Meadows, K. (1999). The Appetite of Households in Early Roman Britain. In Allison (1999), pages 101–121.
- Mitchell, L. G. (1997). *Greeks Bearing Gifts: The public use of private relationships in the Greek world, 435-323 BC*. Cambridge University Press.
- Möller-Wiering, S. (2006). Bronze Age Textiles in Crete. Technical report, The Danish National Research Foundation’s Centre for Textile Research, University of Copenhagen.
- Mook, M. (2011). The Settlement on the Kastro at Kavousi in the Late Geometric Period. In Mazarakis Ainian (2011), pages 477–488.
- Mook, M. S. (1993). *The Northwest Building: Houses of the Late Bronze and Early Iron Ages on the Kastro at Kavousi, east Crete*. PhD thesis, University of Minnesota.
- Mook, M. S. (1998). Early Iron Age Domestic Architecture: The Northwest Building on the Kastro at Kavousi. *British School at Athens Studies*, pages 45–57.
- Moore, J. D. (1996). *Architecture and Power in the Ancient Andes*. Cambridge University Press.
- Moore, J. D. (2003). Life behind Walls: Patterns in the Urban Landscape on the Prehistoric North Coast of Peru. In Smith (2003b).

- Morris, I. (1998). Archaeology as a Kind of Anthropology (A response to David B. Small). In Morris and Raaflaub (1998).
- Morris, I. (1999). Archaeology and Gender Ideologies in Early Archaic Greece. *Transactions of the American Philological Association* (1974-), 129:305–317.
- Morris, I. (2011). Archaeology and Greek Slavery. In Bradley and Cartledge (2011), pages 176–193. Cambridge Histories Online.
- Morris, I. and Raaflaub, K. A., editors (1998). *Democracy 2500? Questions and Challenges*. AIA.
- Mårtensson, L., Andersson, E., Nosch, M.-L., and Batzer, A. (2005-2006a). Technical Report: Experimental Archaeology Part 1. Technical report, The Danish National Research Foundation's Centre for Textile Research, University of Copenhagen.
- Mårtensson, L., Andersson, E., Nosch, M.-L., and Batzer, A. (2006b). Technical report: Experimental Archaeology Part 2:2 Whorl or bead? Technical report, The Danish National Research Foundation's Centre for Textile Research, University of Copenhagen.
- Mårtensson, L., Andersson, E., Nosch, M.-L., and Batzer, A. (2007). Technical report: Experimental Archaeology Part 3 Loom Weights. Technical report, The Danish National Research Foundation's Centre for Textile Research, University of Copenhagen.
- Mårtensson, L., Nosch, M.-L., and Strand, E. A. (2009). Shape Of Things: Understanding A Loom Weight. *Oxford Journal of Archaeology*, 28(4):373–398.
- Mustafa, F. A., Hassan, A. S., , and Baper, S. Y. (2010). Using Space Syntax Analysis in Detecting Privacy: A Comparative Study of Traditional and Modern House Layouts in Erbil City, Iraq. *Asian Social Science*, 6(8):157–166.
- Nevett, L. (2007). Greek houses as a source of evidence for social relations. In Westgate and Whitley (2007), pages 5–10.
- Nevett, L. (2009). Domestic Facades: a 'Feature' of the Urban Landscape of Greek Poleis? In Owen and Preston (2009), pages 118–130.
- Nevett, L. C. (1999). *House and society in the ancient Greek world*. Cambridge University Press.
- Nevett, L. C. (2005). Between Urban and Rural: House-Form and Social Relations in Attic Villages and Deme Centers. In Ault and Nevett (2005), pages 83–98.
- Newman, M. (2010). *Networks: an introduction*. Oxford University Press, Inc.
- Nosch, M.-L. B. and Gillis, C., editors (2008). *Ancient Textiles: Production, Craft and Society. Proceedings of the First International Conference on Ancient Textiles, held at Lund, Sweden, and Copenhagen, Denmark on March 19-23, 2003*, volume 1. Oxbow Books.
- Olivier, L. (2011). *The dark abyss of time: archaeology and memory*. AltaMira Press.

- Ortman, S. G. (2012). *Winds from the North: Tewa origins and historical anthropology*. University of Utah Press.
- Osborne, R. (2012). *Landscape, Ethnicity, and the Polis*. Oxbow Books.
- Owen, S. (2009). The 'Thracian' Landscape of Archaic Thasos. In Owen and Preston (2009), pages 85–98.
- Owen, S. and Preston, L., editors (2009). *Inside the city in the Greek world : studies of urbanism from the Bronze Age to the Hellenistic period*. Oxbow Books.
- Palermo, D. (2001). Luoghi di culto sulla Patela di Priniàs. Per la storia della città fra la tarda età del Bronzo e il VII sec. a.C. *Creta Antica*, 2:159–168.
- Palermo, D., Pautasso, A., and Gigli, R. (2008). Lo scavo del 2007 sulla Patela di Priniàs. Relazione Preliminare. *Creta Antica*, 9:179–208.
- Palmer, R. (2001). Bridging the gap: the continuity of Greek agriculture from the Mycenaean to the historical period. *Prehistory and history: Ethnicity, class and political economy*.
- Parisinou, E. (2007). Lighting dark rooms: some thoughts about the use of space in early Greek domestic architecture. In Westgate and Whitley (2007), pages pp. 213–223.
- Pautasso, A. (2014). Prinias: Une cité crétoise de l'Âge du Fer et son histoire. In Gaignerot-Driessen and Driessen (2014), pages 59–78.
- Perlman, P. (2004). Tinker, Tailor, Soldier, Sailor. The Economies of Archaic Eleutherna, Crete. *Classical Antiquity*, 23:95–136.
- Perlman, P. (2014). Reading and Writing in Archaic Cretan Society. In Pilz and Seelentag (2014), pages 177–206.
- Peyronel, L. (2008). Spinning and Weaving at Tell Mardikh-Ebla (Syria): Some Observations on Spindle-Whorls and Loom-Weights from the Bronze and Iron Ages. In Nosch and Gillis (2008), pages 26–35.
- Phillips Jr., D. A. and Sebastian, L. (2002). Large-Scale Feasting and Politics: An Essay on Power in Precontact Southwestern Societies. In *Identity, Feasting, and the Archaeology of the Greater Southwest*. University Press of Colorado.
- Pilz, O. and Seelentag, G., editors (2014). *Cultural Practices and Material Culture in Archaic and Classical Crete: Proceedings of the International Conference, Mainz, May 20-21, 2011*. De Gruyter.
- Plog, S. (1995). Approaches to Style: Complements and Contrasts. In Carr, C. and Neitzel, J., editors, *Style, Society, and Person*, Interdisciplinary Contributions to Archaeology, pages 369–387. Springer US.
- Pollock, S. (1983). Style and information: An analysis of Susiana ceramics. *Journal of Anthropological Archaeology*, 2(4):354 – 390.

- Prent, M. (2007). Cretan Early Iron Age hearth temples and the articulation of sacred space. In Westgate and Whitley (2007), pages pp. 141–148.
- Psaraki, K., Roumpou, M., Aravantinos, V., and Kalogeropoulos, N. (2013). Food storage and household economy at late Early Helladic II Thebes: an interdisciplinary approach. In Voutsaki and Valamoti (2013), pages 89–102.
- Raaflaub, K. A. and Van Wees, H., editors (2009). *A companion to archaic Greece*, volume 196 of *Blackwell Companions to the Ancient World*. Blackwell Publishing.
- Rabinowitz, A. (2014). Drinkers, Hosts, or Fighters? Masculine Identities in Pre-Classical Crete. In Pilz and Seelentag (2014), pages 91–120.
- Rautman, A. E. (2013). Social Integration and the Built Environment of Aggregated Communities in the North American Puebloan Southwest. In Birch (2013).
- Rich, J. and Wallace-Hadrill, A., editors (1991). *City and Country in the Ancient World*. Routledge.
- Rihl, T. and Wilson, A. (1991). Model settlement structures in Ancient Greece: new approaches to the Polis. In Rich and Wallace-Hadrill (1991).
- Rizza, G. (1974). Ceramiche figurate di Priniàs. In *ant* (1974), pages 153–160.
- Rizza, G. (1983). Priniàs nelle fasi geometrica e orientalizzante. *Annuario della scuola archeologica di Atene e delle missioni italiane in oriente*, 61(61):45–51.
- Rizza, G. (2008). *Priniàs: La Città Archaica sulla Patela*. Consiglio Nazionale delle Ricerche, Catania.
- Rizza, G., Bondi, G., Pautasso, A., and Patanè, R. G. (2003). Priniàs. Scavi degli anni 2002 e 2003. *Annuario della Scuola Archeologica di Atene e delle Missioni Italiane in Oriente*, LXXXI(Serie III, 3 - Tomo II):803–826.
- Rizza, G., Palermo, D., and Tomasello, F. (1992). *Mandra di Gipari: Una officina protoarcaica di vasai nel territorio di Priniàs*. Studi e Materiali di Archeologia Greca. Università di Catania.
- Rizza, G., Pautasso, A., Palermo, D., Patanè, R. G., Biondi, G., and Cultraro, M. (2005). Priniàs. Scavi e ricerche degli anni 2004 e 2005. *Annuario della Scuola Archeologica di Atene e delle Missioni Italiane in Oriente*, LXXXIII(Serie III, 5 - Tomo II):593–624.
- Robin A. Beck, J., editor (2007). *The Durable House: House Society Models in Archaeology*. Center for Archaeological Investigations.
- Rodning, C. B. (2013). Community Aggregation through Public Architecture: Cherokee Townhouses. In Birch (2013), pages 179–200.
- Romanou, D. (2007). Residence design and variation in residential group structure: a case study, Mallia. In Westgate and Whitley (2007), pages pp. 77–90.

- Roumpou, M., Müller, N., Kalogeropoulos, N., Day, P., Nikolakopoulou, I., and Kilikoglou, V. (2013). An interdisciplinary approach to the study of cooking vessels from Bronze Age Akrotiri, Thera. In Voutsaki and Valamoti (2013), pages 33–46.
- Rutter, J. B. (2004). Ceramic Sets in Context: One Dimension of Food Preparation and Consumption in a Minoan Palatial Setting. In Halstead and Barrett (2004), pages 63–89.
- Sallares, R. (1991). *The Ecology of the Ancient Greek World*. Cornell University Press, Ithaca, NY.
- Sarpaki, A. (1992). A Palaeoethnobotanical Study of the West House, Akrotiri, Thera. *The Annual of the British School at Athens*, 87:pp. 219–230.
- Schiffer, M. B. (2002). *The material life of human beings: artifacts, behavior and communication*. Routledge.
- Seamon, D. (1994). The Life of the Place: A Phenomenological Commentary on Bill Hillier's Theory of Space Syntax. *Nordic Journal of Architectural Research*, 1(35-48).
- Shannon, C. E. (1948). A Mathematical Theory of Communication. *The Bell System Technical Journal*, 27:379–423, 623–656.
- Sjögren, L. (2007). Interpreting Cretan private and communal spaces (800-500 BC). In Westgate and Whitley (2007), pages pp. 149–155.
- Skyrms, B. (2010). *Signals: Evolution, learning, and information*. Oxford University Press.
- Small, D. (1997). City-State Dynamics through a Greek Lens. In Nichols, D. and Charlton, T., editors, *The Archaeology of City-States: Cross-Cultural Approaches*, pages 107–118. Smithsonian Institution Press.
- Small, D. B. (1998a). A Democracy of Archaeologies (A Response to Ian Morris). In Morris and Raaflaub (1998).
- Small, D. B. (1998b). An Archaeology of Democracy? In Morris and Raaflaub (1998), pages 217–228.
- Small, D. B. (1998c). Surviving the collapse: the oikos and structural continuity between Late Bronze Age and later Greece. *Gitin et al*, pages 283–92.
- Small, D. B. (2009). The dual-processual model in ancient Greece: Applying a post-neoevolutionary model to a data-rich environment. *Journal of Anthropological Archaeology*, 28(2):205–221.
- Smith, M. L. (2003a). Early walled cities of the Indian subcontinent as “small worlds.”. In Smith (2003b), pages 269–289.
- Smith, M. L., editor (2003b). *The social construction of ancient cities*.

- Snodgrass, A. (1987). *An Archaeology of Greece: the present state and future scope of a discipline*, volume 53, chapter The Early Iron Age of Greece, pages 170–210. University of California Press.
- Snodgrass, A. (1991). Archaeology and the Study of the Greek City. In Rich and Wallace-Hadrill (1991), pages 1–24.
- Sofianou, C. (2011). Loomweights: Use and Manufacture at Trypitos, Siteia. In Glowacki and Vogeikoff-Brogan (2011).
- Souvatzis, S. G. (2008). *A Social Archaeology of Households In Neolithic Greece: An Anthropological Approach*. Cambridge University Press.
- Sporn, K. (2014). Graves and Grave Markers in Archaic and Classical Crete. In Pilz and Seelentag (2014), pages 219–.
- Stark, D. (2004). The vertex degree distribution of random intersection graphs. *Random Structures & Algorithms*, 24(3):249–258.
- Stark, M. T. (1998a). Technical Choices and Social Boundaries in Material Culture Patterning: An Introduction. In Stark (1998b), pages 1–11.
- Stark, M. T., editor (1998b). *The Archaeology of Social Boundaries*. Smithsonian Institution Press, Washington and London.
- Stark, M. T., Elson, M. D., and Clarke, J. J. (1998). Social Boundaries and Technical Choices in Tonto Basin Prehistory. In Stark (1998b), pages 208–231.
- Stucchi, S. (1974). Questioni relative al Tempio A di Priniàs ed al formarsi degli ordini dorico e ionico. In ant (1974), pages 89–119.
- Sturt, F., Stoddart, S., and Malone, C. (2007). Extracting the domestic from indigenous Sicily. In Westgate and Whitley (2007), pages pp. 47–53.
- Tegou, E. (2014). Axos, a Cretan City (1200-500 BC). In Gaignerot-Driessen and Driessen (2014), pages 21–42.
- Thompson, W. (1982). Weaving: A Man's Work. *The Classical World*, 75(4):pp. 217–222.
- Thurstan, V. (1934). *A Short History of Decorative Textiles and Tapestries*. Pepler and Sewell.
- Tiverios, M., Manakidou, E., Tsiafakis, D., Valamoti, S., Theodoropoulou, T., and Gatzogia, E. (2013). Cooking in an Iron Age pit at Karabournaki: an interdisciplinary approach. In Voutsaki and Valamoti (2013), pages 205–214.
- Tomasello, M. (2009). *Why we cooperate*, volume 206. MIT press Cambridge, MA.
- Trigger, B. G. (1991). Distinguished Lecture in Archeology: Constraint and Freedom - A New Synthesis for Archeological Explanation. *American Anthropologist*, 93(3):551–569.

- Tsakirgis, B. (2005). Living and Working Around the Athenian Agora: A Preliminary Case Study of Three Houses. In Ault and Nevett (2005), pages 67–83.
- Tsakirgis, B. (2007). Fire and smoke: hearths, braziers and chimneys in the Greek house. In Westgate and Whitley (2007), pages pp. 225–231.
- Turner, A., Doxa, M., O'sullivan, D., and Penn, A. (2001). From isovists to visibility graphs: a methodology for the analysis of architectural space. *Environ Plann B*, 28(1):103–121.
- Turner, C. G. and Lofgren, L. (1966). Household size of prehistoric Western Pueblo Indians. *Southwestern Journal of Anthropology*, 22:117–132.
- Tversky, A. and Kahneman, D. (1986). Rational Choice and the Framing of Decisions. *The Journal of Business*, 59(4):pp. S251–S278.
- Tversky, A. and Kahneman, D. (1991). Loss aversion in riskless choice: A reference-dependent model. *The quarterly journal of economics*, pages 1039–1061.
- Tversky, A. and Kahneman, D. (1992). Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and Uncertainty*, 5(4):297–323.
- Vogeikoff-Brogan, N. (2011). Domestic Assemblages from Trypitos, Siteia: Private and Communal Aspects. In Glowacki and Vogeikoff-Brogan (2011).
- Voutsaki, S. and Valamoti, S. M., editors (2013). *Diet, economy and society in the ancient Greek world : towards a better integration of archaeology and science : proceedings of the International Conference held at the Netherlands Institute at Athens on 22-24 March 2010*. Peeters.
- Wallace, S. (2010). *Ancient Crete: From Successful Collapse to Democracy's Alternatives, Twelfth to Fifth Centuries BC*. Cambridge University Press.
- Wallace, S. (2014). The Creative City: The Construction of Cretan Society after the 1200 BC Collapse. In Gaignerot-Driessen and Driessen (2014), pages 79–102.
- Wees, H. V. (1998). A brief history of tears: gender differentiation in Archaic Greece. pages 10–53. Routledge, London and New York.
- Welch, P. D. and Scarry, C. M. (1995). Status-related variation in foodways in the Moundville chiefdom. *American Antiquity*, pages 397–419.
- Welsch, R. L. and Terrell, J. E. (1998). Material Culture, Social Fields, and Social Boundaries on the Sepik Coast of New Guinea. In Stark (1998b), pages 50–77.
- Westgate, R. (2007a). House and society in Classical and Hellenistic Crete: a case study in regional variation. *American journal of archaeology*, pages 423–457.
- Westgate, R. (2007b). The Greek house and the ideology of citizenship. *World Archaeology*, 39:2:229–245.

- Westgate, R. and Whitley, J., editors (2007). *Building communities: house, settlement and society in the Aegean and beyond: proceedings of a conference held at Cardiff University, 17-21 April 2001*, volume 15 of *British School At Athens Studies*. British School of Athens.
- Whallon, R. (1969). Rim Diameter, Vessel Volume, and Economic Prehistory. *Michigan Academician*, 11(2):89–98.
- White, D. (1963). A Survey of Millstones from Morgantina. *American Journal of Archaeology*, 67(2):pp. 199–206.
- Whitley, J. (1991). Social Diversity in Dark Age Greece. *The Annual of the British School at Athens*, pages 341–365.
- Whitley, J. (1994). The Monuments That Stood before Marathon: Tomb Cult and Hero Cult in Archaic Attica. *American Journal of Archaeology*, 98(2):pp. 213–230.
- Whitley, J. (1996). Gender and hierarchy in early Athens [The strange case of the disappearance of the rich female grave]. *Mètis. Anthropologie des mondes grecs anciens*, 11(1):209–232.
- Whitley, J. (2001). *The archaeology of ancient Greece*, chapter The City, the State and the Polis, pages 165–194. Cambridge University Press.
- Whitley, J. (2009). Crete. In Raaflaub and Van Wees (2009), pages 273–293.
- Wright, J. C. (2004). Mycenaean Drinking Services and Standards of Etiquette. In Halstead and Barrett (2004), pages 90–104.
- Yaeger, J. (2003). Untangling the Ties that Bind: The City, the Countryside, and the Nature of Maya Urbanism at Xunantunich, Belize. In Smith (2003b), pages 121–155.
- Yasur-Landau, A. (2006). The Last Glendi in Halasmenos: Social Aspects of Cooking in a Dark Age Cretan Village. *Aegean Archaeology*, 7:49–66.
- Zeder, M. A. (2003). Food provisioning in urban societies: A view from northern Mesopotamia. In Smith (2003b), pages 156–183.